# ELECTRICAL REVIEW

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15 JANUARY 1954

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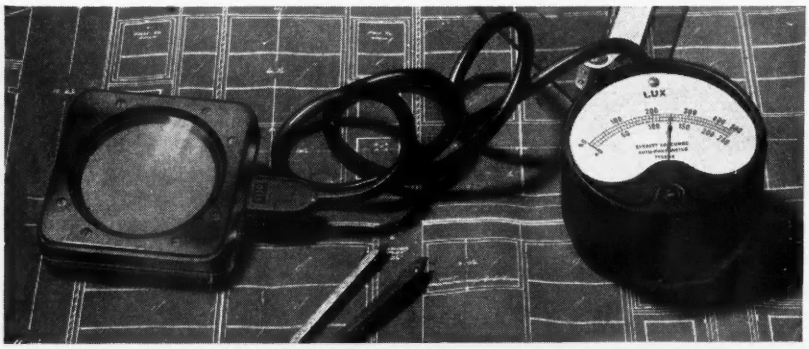
VOLUME 154 ✧ NUMBER 3

*Eighty-Second Year of Publication*

FRIDAY ✧ ONE SHILLING

**Editorial, Advertising and Publishing Offices:** Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A. Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

# Portable TEST INSTRUMENTS




**An indication of the range of portable instruments manufactured by Everett Edgcumbe**

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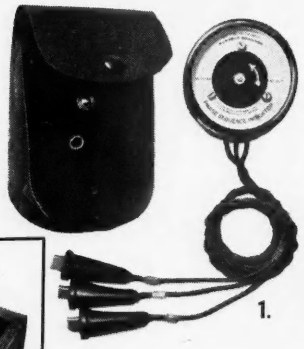

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ELECTRICAL REVIEW

15 January 1954 Vol. 154 No. 3 Established 1872

# Steel and Electricity

PUBLICATION in this issue of the last of the series of articles designed in 1951 to deal with some of the main electrical aspects of the new steelworks at Port Talbot of the Steel Company of Wales, Ltd., again focuses attention on this extraordinary development. To mention a few points from the articles which have been published from time to time since the initial article in the *Electrical Review* of 27th July, 1951, will assist in the re-picturing of the works: an integrated steel making plant, 4½ miles long and 1½ miles wide (average) embracing the old Port Talbot, Margam and Abbey Works; a public electricity supply with several incoming 66 kV lines to a works substation equipped with over 80,000 kW of transformer plant; an expenditure on the electrical equipment of ten million pounds; a total capacity of production electrical equipment of 175,000 h.p. represented by 6,000 electric motors; three new blast furnaces designed to give an output of 19,000 tons a week; a slabbing mill which deals with 20 ton ingots and has an output of 300 tons a week, each roll being driven by a double armature 4,600 h.p. motor which can develop in combination a peak horse-power of 27,000; a hot strip rolling plant, the continuous rolling train of which is supplied by a bank of thirty 700 kW rectifiers; and finally, in this issue, an electrolytic tinning plant which is probably the largest and fastest in continuous operation in this country, having tinning lines which run at a speed of up to 800ft per minute.

These and other outstanding developments in other parts of the country, for instance, the developments at the Consett Iron Works which include three 5,000 tons per week blast furnaces and the rendering of the continuous rolling mill works of John Summers & Sons, Ltd., self-contained by virtue of an installation of coke ovens and what are believed to be the largest blast furnaces in the world outside the United States (8,000 tons a day); all stress the interdependence of the electrical and steel industries, and support the contention expressed in the *Electrical Review* as far back as 16th April, 1937, that it is not sufficient merely to say that the electrical industry has served the iron and steel industry well. Some of the present-day alloy steels could not have been evolved without the refining qualities of the high-frequency furnace, and cold rolling of steel strip could not have been brought to its present high standard without that precision of automatic control which is only possible electrically. And the greater importance of both of these electrical developments lies in the fact that they have opened up vast new fields of exploration for the metallurgist, with consequent great commercial developments as the result of the greatly improved "workability" of the material.

## A BROAD BACKGROUND

So wide a field is covered by the term " electrical engineering " that many concerned with special aspects find increasing difficulty in keeping in touch with progress in other branches and thus in relating their own activities to the whole. The value to these of Mr. H. Leyburn's Parsons Memorial Lecture, reported in this issue, was that it was not intended for the expert but rather, as he put it, " to show one half of the engineering world what the other half does." We ourselves found much value in seeing clearly the fuller picture of supply continuity, the components of which we had become familiar with in the fields of transmission and distribution, relating mainly to radial, ring main and interconnected systems; and in the field of protection against fault currents and overloads, relating mainly to balanced-feeder, phase-comparison and distance protection. His survey of the methods adopted by power system engineers to meet the more and more onerous conditions imposed by growth of load and of transmission distances gave a true perspective to electricity supply developments. The basic principles he laid down are likely to hold good in any foreseeable circumstances, such as the erection of atomic power stations on sites at some distance from centres of consumption.

## TAX REDUCTIONS

Press comments on last week's reductions in purchase tax have not generally stressed an important point: the levelling down of the tax on electric heaters to bring it into line with the charge on gas appliances. Even at the new rate the tax is too high. Electric space heating and water heating equipment is still regarded as being of the same nature as, say, jewellery the tax on which was also reduced from 75 to 50 per cent. The lowering of the tax to 25 per cent in the case of " washing machines which are designed for heating water by electricity or gas but which are not otherwise designed for operation by electricity or gas " has little effect. It is by no means clear whether these alterations represent the whole of this year's concessions or whether they will be followed by others. Nevertheless, the idea of introducing them an appreciable time before Budget Day is a good one—so far as it goes, and in the broader view any remission is welcome.

## NEW POWER PLANT

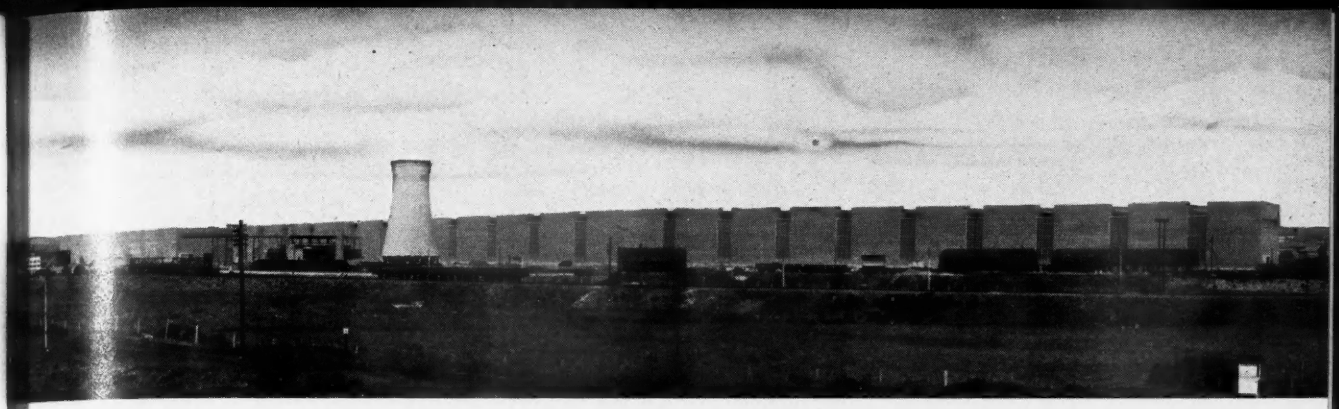
In 1952 the new generating plant commissioned by the British Electricity Authority amounted to 1,539 MW output capacity, representing an increase of 38 per cent on the record figure for the previous year (1,113 MW). In 1953, as was shown in last week's *Electrical Review*, the output capacity of plant commissioned was 1,413 MW, a decrease of 8 per cent from the 1952 total. While there is probably no special significance in this reduction in relation to the increase in 1952, it is worth noting that plant put into service in 1952 was well above the maximum " target " figure of 1,400 MW for that year, and that the 1953 figure was slightly above the mean planned capacity, also 1,400 MW. We believe, however, that the decrease during 1953, following the sharp increase during 1952, may well indicate that the B.E.A. is catching up on the generating plant shortage of the past ten years or so, and is now approaching the time when the main object of new commissionings will be to keep pace with normal load growth and plant replacements, although the Authority considers that an annual addition of 2,000 MW is necessary. Of the new 1953 plant 31 per cent was installed in eight new power stations and the remainder took the form of extensions in twenty-six existing stations, many of which, however, are post-war stations.

## REGRETTABLE DECISIONS

The Electrical Trades Union's threat to resume the strikes at selected sites at which work is being carried out by members of the National Federated Electrical Association was carried into effect on Monday last. Next Monday it is intended to call a 24-hour total stoppage throughout the electrical contracting industry. While conceding the Union's right to take such action we can still question its wisdom and the same may be said of the decision of the N.F.E.A. to retaliate by corresponding lock-outs. The strikers will regard this move as a challenge and will be confirmed in their intransigent attitude. If the Association really intended business it would have been more effective to declare a total lock-out instead of indulging in rather puerile retaliation. Not that we believe that either strikes or lock-outs are the ways in which such differences should be settled. The Minister of Labour has had this matter reported to him for reference to the Industrial Disputes Tribunal. If each party considers that it has a good case it should not be afraid of submitting to impartial judgment. All such disputes must eventually end in compromise; why should the public, and the two parties themselves, suffer loss through futile stubbornness and clashes of personalities.

## IRRATIONAL RETICENCE

There has recently appeared in the national Press an advertisement by a furniture-making company extolling the virtue of one of its chairs about which it is said: " There is nothing cheap about . . . chair except the price." After stressing its good points the announcement concludes " . . . there simply *is* no other chair—not within anything like the price." The reader is fully acquainted with almost everything about this article. Only one piece of information is withheld—the price. This is an extreme example of an irritating and archaic custom of many advertisers and shopkeepers. We know what is behind it: the hope or belief that the would-be buyer will ask the price and thus become a " prospect." The validity of this idea is doubtful; the practice probably scares off more people than it catches, for the immediate inference is that the sellers are afraid of their price. We suggest to electrical manufacturers and dealers that straightforwardness in the matter of prices is more likely to result in business—particularly in to-day's buyers' market.



# High-Speed Tinplate Production

*Trostre Works of the Steel Company of Wales*

THIS article concludes the series dealing with the activities of the Steel Company of Wales and it is concerned with the manufacturing processes and electrical equipment at the Trostre Works near Llanelly where hot-rolled coiled steel strip from the Abbey Works is cold reduced in a five-stand tandem mill and converted into hot-dipped and electrolytically tinned plate. Like the rest of the company's works Trostre makes the maximum use of electrical methods, but before proceeding to describe the equipment involved it would be as well to run over the layout of the plant and the fundamentals of the processes which are carried out.

In plan form the main buildings are like an unequally limbed letter " U." The longer limb, which contains the hot-rolled coil storage at its extremity, lies to the south and points eastwards. From this storage area the material flow line passes along the southern bay, which is 2,280ft long by 120ft wide, and follows round the " U " until the finished tinplate emerges from the eastern extremity of the 1,560ft long by 120ft wide northern bay.

The hot-rolled coils are supplied by the Abbey Works in various steel qualities and up to 0·093in thick and 38in wide. They have a maximum weight of 15,000 lb and are normally brought from Abbey 26 miles away in special 42-ton rail wagons, but road transport can quickly be organized if necessary. As the coils move westwards from the storage area they are first processed in the continuous pickler to remove the hot-mill scale and then put through the five-stand tandem mill for cold reduction to the required gauge. They next pass through one of two electrolytic cleaning lines to remove the palm oil used in cold reduction, because it would carbonize during annealing and cause trouble in tinning.

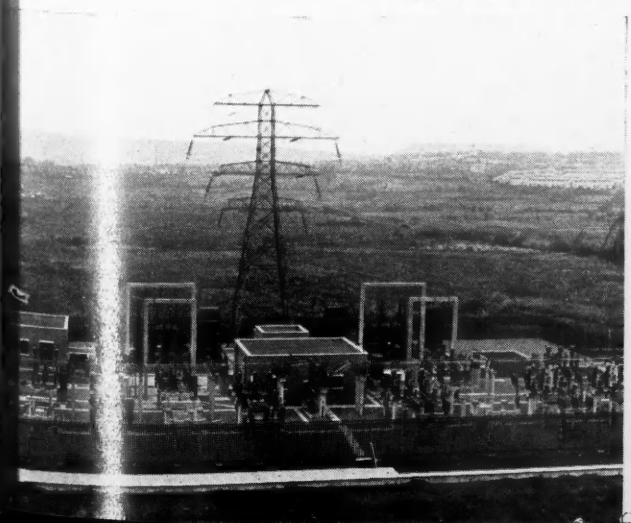
The coils are then transferred to the annealing department, which is a separate bay 600ft long by 120ft wide adjoining the main southern bay. After annealing, the coils go back to the main southern bay for skin-passing in one of the two two-stand tandem temper mills. This imparts to the blackplate a surface suitable for tinning and confers mechanical properties which may be adjusted to suit the purpose for which the tinplate is intended.

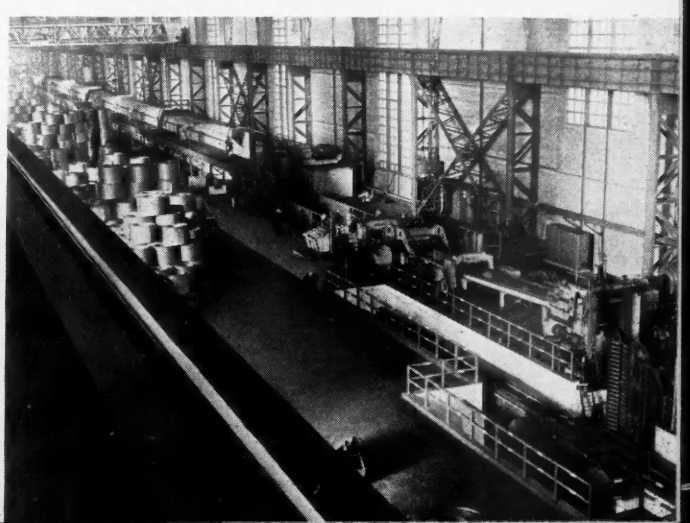
The base of the " U " is formed by two adjacent bays. The one next to the main southern bay is 840ft long by 120ft wide, and comprises from east to west, the roll shop, 320ft long, the machine shop, 200ft long, and the shearing and trimming bay, 320ft long. The other bay has a length of 680ft and contains the general stores and the casting equipment for electrolytic tin anodes.

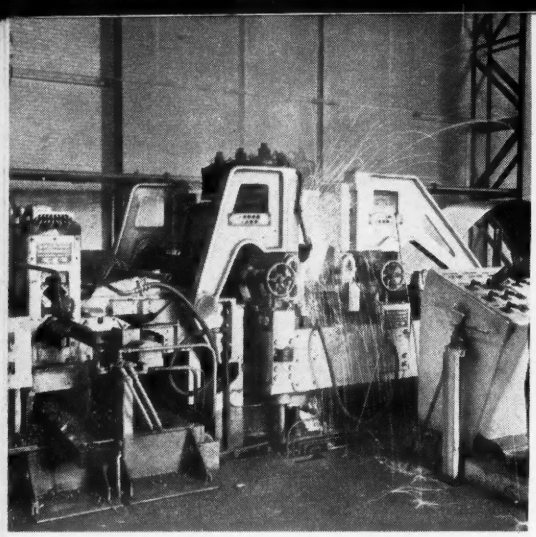
After temper rolling the flow line divides and the coils intended for hot-dip tinning pass through one of the three coil cut-up lines where they are side- and end-sheared to plate sizes required by customers. Coils for electrolytic tinning pass through one of the two coil preparatory lines where they are side-trimmed only. The sheared and trimmed material then passes to the main northern bay which houses, from east to west, the hot-dip tinning bay, two electrolytic tinning lines, the warehouse and shipping area.

To the north of the main block lie various administration

*The electricity supply to the works is at 132 kV from the grid over a double-circuit line to the main substation. On the production line (right) the first item of plant is the 48in continuous pickle line*







*Left: Coils are joined alternately by welding and stitching. Right: General view of the five-stand tandem cold reduction mill*

and service buildings, including the main substation, while on the south are the boiler house, cooling tower, south substation, N.X. plant (which produces oxygen-free nitrogen for the annealing process) and service sidings. At appropriate positions along the northern wall of the main southern bay are the five-stand motor and switch rooms, the palm-oil recovery system, acid storage and recovery plant, and the east substation. All other electrical equipment is in the basement below the particular production line with which it is associated.

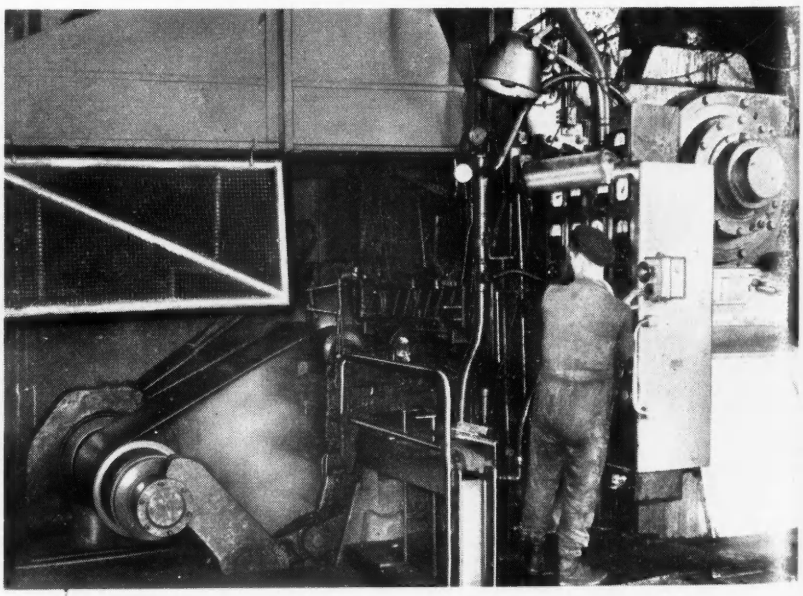
The electricity supply to the works is at 132 kV from the grid over a double-circuit line to the main substation in which the B.E.A., the South Wales Electricity Board and the Steel Company of Wales all have equipment. Each circuit of the incoming line feeds, through isolators, two 45 MVA 132/33 kV transformers, each having ample capacity for the full load of the plant. These are connected through two 33 kV switches to a 33 kV busbar having a bus section switch and five feeder switches. All this Reyrolle switchgear is 750 MVA pneumatically operated small-oil-volume gear, remotely controlled from the central substation near the five-stand mill motor room. The feeder switches connect to three 12·5 MVA and two 10 MVA 3·3/11 kV J. & P. transformers. The two 10 MVA transformers serve as unit transformers for the main motor-generator sets for the five-stand mill, thus allowing these to be switched from the 33 kV gear. A stand-by supply for these two sets is obtained from one of the 12·5 MVA transformers through off-load change-over switches on the 11 kV side.

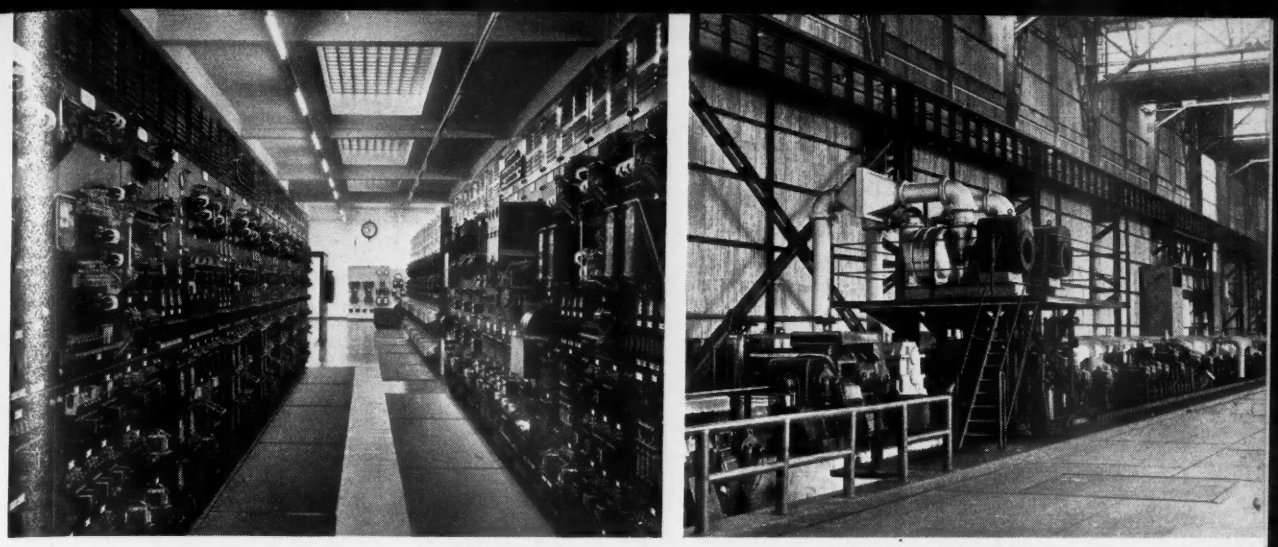
The three 12·5 MVA transformers, which are placed conveniently with respect to the three main load centres in the works, feed 250 MVA 11 kV Reyrolle switchboards. To keep the rupturing capacity down to 250 MVA and also provide a stand-by supply these boards can be coupled through three sets of B.T.H. cast-in-concrete reactors. The switchgear is of the metalclad horizontal draw-out type, compound filled, with remote control and indication panels. The switches feed further step-down transformers and motors above 1,000 h.p. Three 3·5 MVA 11/3·3 kV Brush transformers, fed from the 11 kV boards, supply to three 150 MVA 3·3 kV English Electric air-break switchboards, all of which can be interconnected. They serve motors in the range 100 to 1,000 h.p.

The national standard, 415/240 V three-phase four-wire, has been adopted for general power and lighting services. About twenty Bryce standard 800 kVA transformers step down from 11 kV. Two transformers feed each of the main switchboards, the latter being interconnected in pairs through the feeders to the contactor and switch fuseboards. The total load on each group can be carried by three of the four transformers. The main switchboards comprise English Electric air-insulated air-break gear. Portable equipment is fed from plug points on a 110 V system with centre point earthed served by Foster 415/110 V transformers.

There is a 230 V d.c. distribution scheme for feeding the cranes, mill screwdown motors and some auxiliary motors. Four B.T.H. 300 kW twelve-phase pumpless steel tank rectifier units are used with their transformers

*Cold reduced strip comes off the five-stand mill at speeds up to 4,500 ft/min*





*Left: Some of the five-stand mill motor control gear. Right: Exit end of one of the two electrolytic cleaning lines*

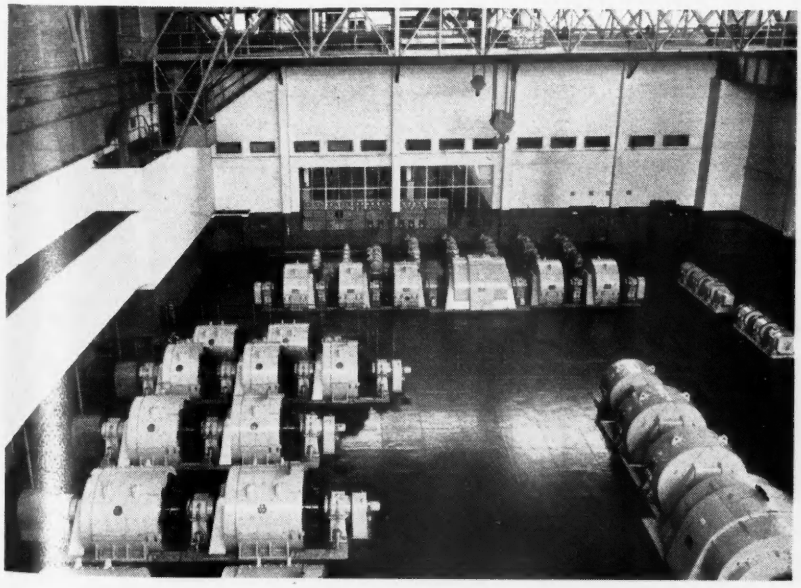
fed from 11 kV. All of the four E.C.C. air-break switchboards are interconnected and the system has an electronic automatic loading panel to prevent undue voltage rise during feedback and light load conditions.

Throughout the works a.c. squirrel-cage motors have been used almost exclusively for the auxiliary drives and controls. It has thus been possible to achieve complete standardization; the smaller machines were supplied by Lancashire Dynamo & Crypto, Ltd., and the larger ones by the English Electric Co., Ltd. Control gear is also standardized; the open panels are Igranic and the metal-clad units of Donovan manufacture. In all cases, direct-on-line starting is employed.

In cabling, full use has been made of the basement construction to house much of the electrical equipment. The cables are run on racks or perforated trays. Most of the h.v. cables are p.i.l.c. s.w.a. with fireproof braiding, supplied by Crompton Parkinson, Ltd. The medium and l.v. cables are of three main types, p.i. and v.r.i. aluminium sheathed supplied by Johnson & Phillips and Pyrotenax. Special p.v.c. covered cable supplied by Cables & Plastics, Ltd., is used in highly corrosive sections.

Most of the works lighting is provided by B.T.H. high-bay fittings which incorporate two horizontally burning 400 W mercury vapour lamps mounted symmetrically around a 1,000 W tungsten lamp. The fittings are mounted at a height of about 45ft to ensure adequate diffusion and give a high intensity light with good colour rendering properties.

*Five-stand mill motor room with mill motors to left and control room through window at rear*



## Pickling Process

To return to the production side: the first item of plant in the process is the 48in continuous pickle line, for which the electrical equipment of the main drives was supplied by the General Electric Co., Ltd. It is arranged to handle 44in wide strip at speeds up to 500 ft/min and it is divided into three sections, namely entry, tank and delivery. As it is essential that the strip shall be kept moving while it is in the acid baths, there are looping pits situated at each end of the tank section in order that the strip may be fed into and cleared from the line while the tank section is running.

Having been mechanically loaded on to the uncoiler mandrel, the leading edge of a new coil is fed into the "McKay" processor, which takes charge and unwinds against back tension. The mandrel drag drive is a forced-ventilated machine rated at 65 kW over a speed range of 610/1,280 r.p.m. Voltage variation of −32 V to +60 V for tension control is provided by a booster set driven by a 21 h.p. squirrel-cage motor which also drives a pilot exciter. The processor is driven by a 445 h.p. totally-enclosed forced-ventilated motor.

The staggered rolls of the processor loosen the scale and assist the pickling. On reaching the shear, which is driven by a 50 h.p. Metro-Vick mill-type d.c. motor, the leading edge of a new coil and the trailing edge of an old coil are squared off to permit satisfactory welding or stitching. If the strip is to be welded, it is brought up to the trailing edge of the preceding coil already waiting in the trailing edge clamps of the British Federal flash

welder, the latter being fed from an 800 kVA transformer. After welding the strip is inched forward to the motor operated stripper. Coils are joined alternately by welding and stitching and in this way the coil size is built up to a maximum of 30,000 lb for cold reduction.

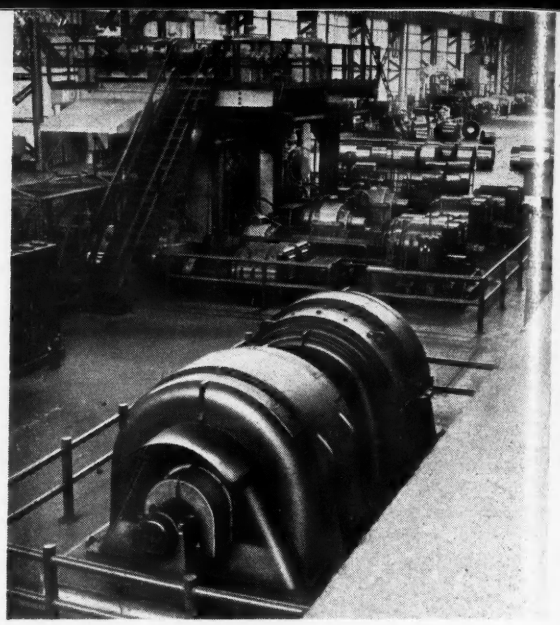
For stitching, the leading and trailing edges are overlapped at the stitcher, the stitches being flattened by passage through pinch rolls. The drive of the former is a 50 h.p. mill-type d.c. motor. Strip is constantly drawn from the looping pit at the entry end, passed through the acid tanks, washed, dried and fed into the delivery end pit by the entry and follower pinch rolls. These rolls may be controlled from the entry or delivery section desks, as selected by the operator on the delivery desk. After leaving the entry section looping pit, the strip passes into a controlled loop, the height of which is governed by a dancer roll and a regulator which controls the shunt field of the 97·5 h.p. entry pinch roll motor.

All three sections of the pickle line are Ward-Leonard controlled, the control gear and m.g. sets being housed in a forced-air-ventilated room. The main m.g. is a six-machine set, driven by a 1,250 h.p. 11 kV 1,000 r.p.m. synchronous motor. There are two exciters, one of 12 kW associated with the main motor and a 20 kW unit for exciting generators and driving motors on the pickle line. The remainder of the set comprises three 300 V generators rated at 350/455 kW, 125/162 kW and 175/225 kW which feed the entry, tank and delivery sections respectively. The set is self-ventilated and arranged for reactor starting.

## Cold Reduction

The coils next go to the five stand-tandem United Engineering mill the drive for which is basically the same as that for the three-stand tandem cold reduction mill at Abbey (see *Electrical Review*, 20th November, 1953, page 1147) and all the main electrical equipment was supplied by the British Thomson-Houston Co., Ltd. The mill comprises five similar four-high stands at 13ft centres, each having work rolls of 21in diameter by 48in long, and back-up rolls 53in in diameter and 47in long, followed by a 20in diameter automatic expanding and collapsing tension reel. The mill is capable of reducing strip measuring up to 44in in width and 0·062/0·100in thick to strip 0·004/0·035in thick at speeds up to 4,500 ft/min, which is over 50 m.p.h.

The strip is fed into each stand in succession, a heavy tension being applied to the strip between stands. The



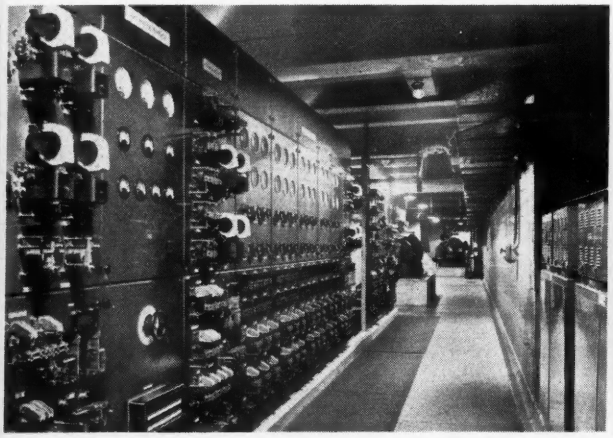
*Temper mill from the drive side ; main m.g. set in the foreground*

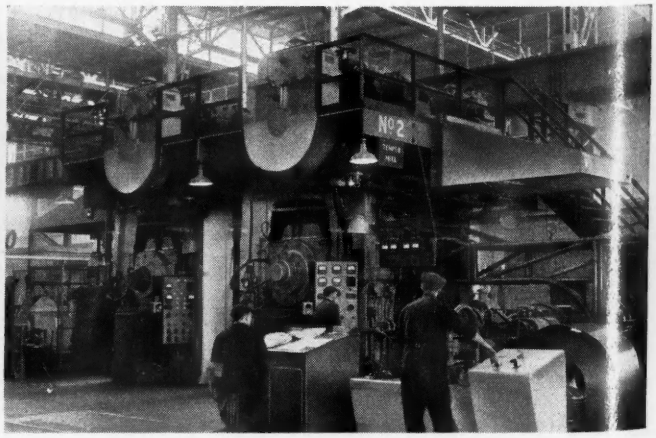
stands and reel are driven individually, each stand motor driving the bottom work roll direct and the top work roll through the pinion stand; the reel is directly driven by its motor. To meet the speed requirements d.c. motors are used, thus enabling the relative speeds to be adjusted by armature voltage and field control and the speed of the mill to be regulated by armature voltage. The screwdowns are each driven through gearing by a 50 h.p. Metro-Vick d.c. shunt motor at 550 to 1,750 r.p.m., the vertical travel being indicated by " Selsyn " screwdown meters mounted on the control cabinets.

Near the mill is the motor room containing the m.g. sets and mill motors. There are also auxiliary exciter sets for control supplies, synchronous motor excitation, and for stand and reel control. The last-named sets are segregated so that there is one per stand and two for the reel. Facing a window in the motor room, but situated in the control room, is the supervisory panel which carries switches for starting the sets and a full set of instruments, indicating and recording, with alarm annunciators, which give a complete picture of the performance of the electrical equipment.

The start and finish of each coil has to be threaded through the mill at low speed, so for efficient working it is necessary to have rapid acceleration and deceleration. Thus, multi-armature machines are used to keep down the

*Some of the control equipment and auxiliaries associated with the cleaning lines. The temper mills (right) are designed to operate at speeds up to 4,000 ft/min*





moment of inertia and it is believed that they rank among motors having the largest ratio of armature core length to core diameter driving rolling mills anywhere in the world. Particulars of the motors and their associated generators are given in the table.

Each armature of the stand motors is fed by its own 1,600 kW 600 V generator, while a single 731 kW 600 V generator supplies the two reel motor armatures. These generators are grouped in two sets each driven by an 11,580 h.p. 750 r.p.m. 11 kV three-phase synchronous motor, the necessary supply being derived from the 10 MVA transformers mentioned earlier. Reactor starting is the normal procedure, but direct-on-line starting is possible in an emergency as a specially designed squirrel-cage starting winding is incorporated. The sets start completely automatically once the line circuit breaker has been closed and after the motor has synchronized amplidyne control of synchronous motor excitation maintains either constant power factor or constant reactive kVA.

FIVE-STAND MILL DRIVE MOTORS AND GENERATORS

| Motors | | | | | Generators | | | |
|---|---|---|---|---|---|---|---|---|
| Stand | No. of armatures | Total h.p. | Motor r.p.m. | Mill speed ft/min | No. of generators | Total kW | Generator voltage | M.G. set No. |
| 1 | 1 | 1,750 | 90/230 | 495/1,260 | 1 | 1,600 | 600 | 1 |
| 2 | 2 | 3,500 | 125/273 | 688/1,500 | 2 | 3,200 | 600 | 1 |
| 3 | 2 | 3,500 | 200/400 | 1,100/2,200 | 2 | 3,200 | 600 | 1 |
| 4 | 2 | 4,000 | 350/582 | 1,925/3,200 | 2 | 3,200 | 600 | 2 |
| 5 | 3 | 5,500 | 500/818 | 2,750/4,500 | 3 | 4,800 | 600 | 2 |
| Reel | 2 | 900 | 210/900 | — | 1 | 731 | 600 | 1 |

Each of the two m.g. sets is driven by an 11,580 h.p. 750 r.p.m. 11 kV three-phase synchronous motor.

This individual generator system gives great flexibility, with a wider speed range on each stand, by voltage variation of the stand generator group, in addition to the normal motor field control range. The fault capacity and short-circuit forces of each stand system are also greatly reduced compared with the common busbar system, and the copper work is much lighter.

The armatures of the multi-armature motors are connected in series, thus ensuring load sharing as they all carry the same current. The alternate series connection is used (motor-generator-motor) so that the voltage across any part of the circuit does not exceed that required by one armature even under fault conditions. Because of the relatively low full-load current and fault capacity of each individual generator system, line contactors are used instead of circuit breakers for fault protection.

Seven separate auxiliary exciter sets are provided for control supplies, synchronous motor excitation and for stand and reel control and these are situated in the motor room in front of the window looking into the control room where the starting equipment is installed. Control of the mill, which is largely based on amplidynes, is exercised from a number of control cabinets mounted on the mill housings.

In the rolling of a coil, the motors are first run at a very low speed while the forward coil end is fed through the stands and on to the reel. All the motors are then rapidly accelerated by raising the volts of all the generators, the final speeds of all the motors being determined by the setting of their individual motor field rheostats.

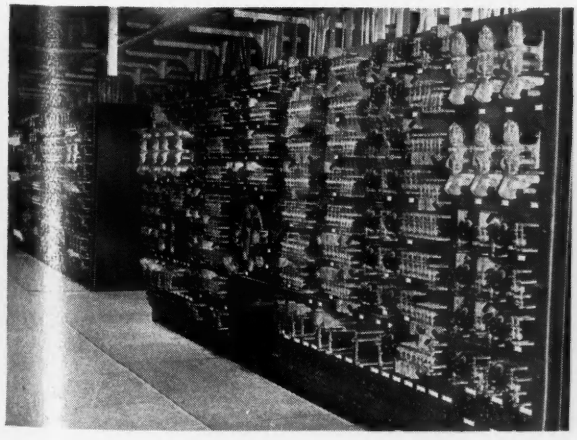
As the coil nears completion, the speed of the motors is rapidly reduced by lowering the generator voltages and the tail of the strip runs out of the mill on to the coil. While this coil is being removed from the reel the next coil is threaded into the mill. The greatest accuracy in relative speed control of the motors is necessary in order to avoid undue tension variations in the strip between the stands, and it is essential to maintain constant tension between the last stand and the reel, notwithstanding that the coil is steadily building up in diameter and, consequently, the reel motor correspondingly slowing down. It is for these reasons that amplidynes are used to control each main unit.

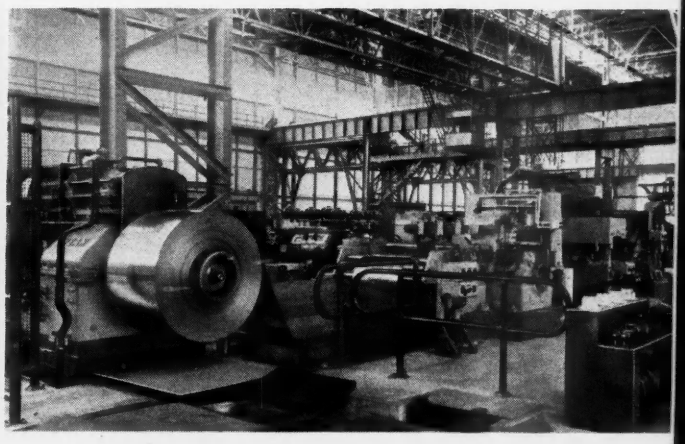
## Electrolytic Cleaning

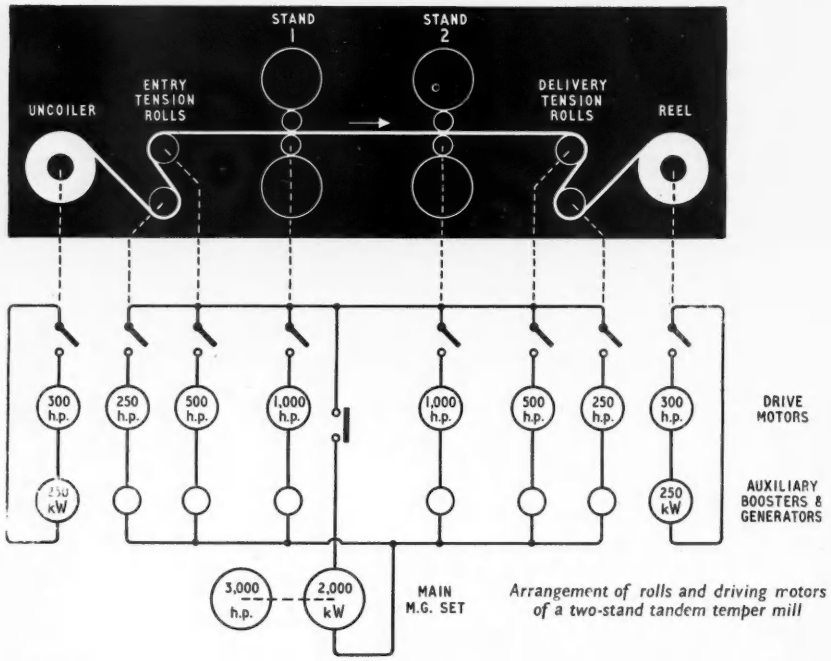
Having been cold reduced the coils are next passed through either of the two electrolytic cleaning lines to remove the palm oil. Each of the lines is designed to clean coils weighing up to 30,000 lb with a maximum strip speed of 2,000 ft/min, and is divided into two main sections—the entry section, which deals with the uncoiling, cleaning, drying and washing of the strip, and the delivery section where the re-coiling is done. The electrical equipment for the main drives of these cleaning lines was supplied by the Metropolitan-Vickers Electrical Co., Ltd.

From the pay-off reel at the entry section the strip passes through cleaning, scrubbing, electrolytic and rinsing tanks and hot air dryers, where it is handled by deflector, submerger, wringer and scrubber rolls (driven by twenty-six 5 h.p. motors) before entering the master pinch rolls, which supply the power for dragging the strip through the tanks and dryers. The scrubber brush drives comprise eight 10 h.p. squirrel-cage motors, while master pinch rolls are

*Contactor panels associated with one of the two temper mills and (right) entry end of coil preparatory line which has a maximum speed of 1,800 ft/min, and will handle 38in wide coils weighing up to 30,000 lb*








*Arrangement of rolls and driving motors of a two-stand tandem temper mill*

driven by a 125 h.p. 850/1,065 r.p.m. 440 V machine. The strip then passes through a 20ft deep looping pit to the tension rolls, whence it is wound under tension on to the reel.

On each line the power is supplied to the main drives from a m.g. set in the basement which comprises a 415 h.p. 980 r.p.m. 3·3 kV squirrel-cage motor driving a 0/250 kW 0/440 V generator and a 25 kW 230 V constant voltage exciter. The pay-off reel drives a 40 kW 225/1,000 r.p.m. drag generator, which feeds back to the main 250 kW d.c. generator through a booster. Ventilation of the drag generator is by a pick-a-back fan and filter unit, which supplies air at 2,000 cu ft/min to the non-driving end of the machine.

The 26 auxiliary roll motors are 5 h.p. 1,150/1,500 r.p.m. totally enclosed fan cooled machines which are connected in parallel and supplied from the 440 V generator through a series booster providing the IR compensation required by the relatively high regulation of the small motors. The master pinch rolls are driven by a 125 h.p. motor which is supplied from the main generator through a series wound booster.

The 100 kW generator for the tension roll drag is identical to the master pinch rolls motor and supplies the main generator through a booster, which has shunt as well as series windings to enable the speed of the exit end of the line to be controlled by photocell equipment installed in the looping pit.

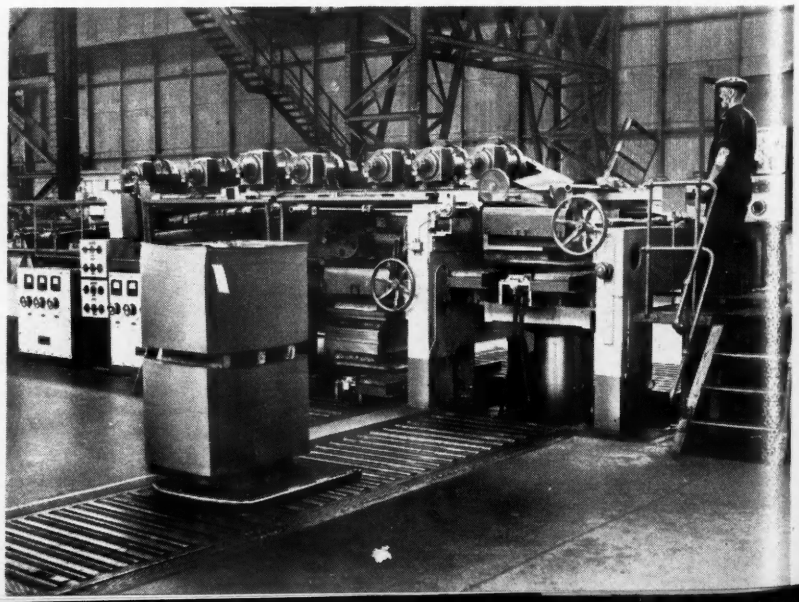
Finally the reel is driven by two 75 h.p. 225/1,000 r.p.m. shunt wound motors having series stability turns and coupled in tandem, connected in series and fed through a booster. The boosters are protected

machines and are driven by a 100 h.p. 1,460 r.p.m. 415 V squirrel-cage motor. Besides the booster set two metadyne sets are provided, one for the reel and the other for the pay-off tension schemes; each comprises two metadynes and a driving motor. The booster and metadyne sets are arranged for direct-on-line starting and are situated in the basement, together with the contactor control gear which is mounted on open type boards 8ft high and totalling 60ft in length.

As a consequence of pickling, cold-reducing and cleaning, the grain structure of the coils is severely distorted so they are taken to the annealing department where the cycle of operations is varied according to the purpose for which the tinplate is required. After annealing, the metal is practically the required thickness, but it is soft and so it is rolled in one of the two United Engineering two-stand tandem temper mills to bring it down to the required gauge and give it correct grain structure and finish. Extreme care is necessary in controlling and operating the mills to prevent breakage, wrinkling or buckling so two pairs of separately-driven tension rolls are introduced. The two rolls in each pair must not be in contact with each other and the gain in tension depends on the coefficient of friction between the strip and the rolls.

The mills are designed for temper rolling strip ranging in thickness from 0·025in to 0·004in at speeds up to 4,000 ft/min and the electrical drives (see diagram) and controls were supplied by the General Electric Co., Ltd. Each stand is driven by a forced-ventilated closed air circuit 1,000 h.p. 500 V motor with a range of 700/950 r.p.m. The top tension rolls are driven by 500 h.p. 735/1,100 r.p.m. motors and the bottom rolls by 250 h.p. 735/1,100 r.p.m. machines. All these six machines are supplied from the main 2,000 kW motor generator set, which is driven by a 3,000 h.p. 11 kV 500 r.p.m. synchronous motor designed for reactor starting.

*Exit end of shearing and classifying line*

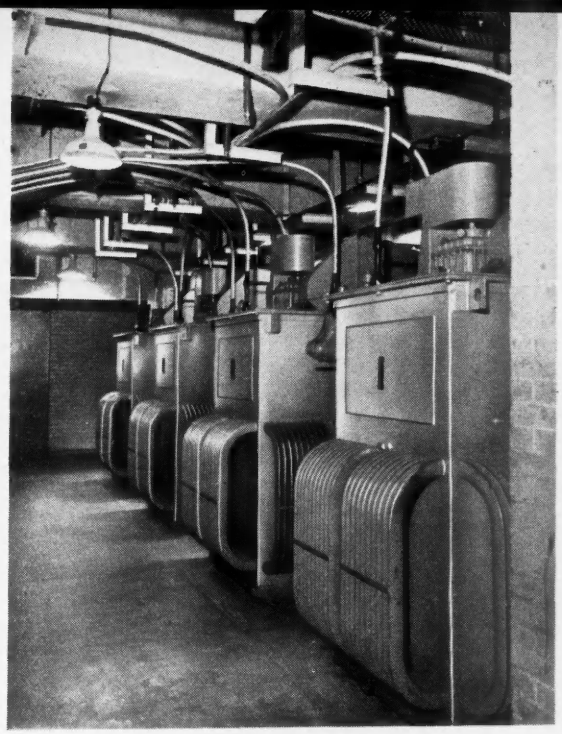


The 300 h.p. 500 V 185/835 r.p.m. uncoiler and reel motors receive their power from an auxiliary m.g. set which comprises a 500 h.p. 1,000 r.p.m. 3·3 kV synchronous motor, arranged for direct-on-line starting and coupled to two 250 kW generators, all these machines being of the self-ventilated protected type. Single-step dynamic braking is provided for all the mill driving motors. For the excitation of the various machines a separate m.g. set is provided, consisting of a 120 h.p. squirrel-cage motor driving four exciters, two for the driving motors of the main and auxiliary m.g. sets, a third for supplying constant voltage excitation and the fourth for main control excitation. In addition there is a booster set for the stand and tension roll motors, which comprises six d.c. machines with outputs ranging from 21 to 67·5 kW.

The main control gear for the temper mills is of the contactor type mounted on open type panels, the mill being operated from control cabinets on the mill stands. The equipment is so designed that the time taken to accelerate the mill from rest to full speed can be varied from 12 to 20 sec, while that for stopping from full speed can be adjusted between 5 and 20 sec. The speed of the mill as a whole is varied by controlling the voltage of the main generators by means of a cascade exciter of which one field winding is energized from the reference voltage bus-bars. The voltage of these bars is determined by a motor-driven potentiometer which permits ready alteration of the acceleration times. The rate of rise of reference voltage, as shown by the speed of the motor-driven potentiometer, provides an acceleration signal which is used to ensure the correct relationship between the speeds of the tension roll and main stand motors. Facilities for automatic inter-stand tension control and IR compensation are also provided.

As the strip passes from the uncoiler to the entry tension rolls and from the delivery tension rolls to the coiler, constant tension is ensured under all conditions by controlling the generator excitation so as to maintain a pre-selected armature current in the motor while varying its excitation (and consequently its torque) automatically in proportion to the reel diameter. During periods of changing speed, constant tension is preserved by increasing or decreasing the torque of the driving motor, the change in torque taking into account the rate of change in speed and the change in the inertia of the reel. The control is such that stalled tension may be maintained if strip is in the mill at standstill. The stalled tension can be released as desired.

The material flow line now divides, coils for electrolytic tinning going to the coil preparatory lines for side trimming while those for the hot-dip process go to the shearing and classifying lines. The electrical equipment for the coil preparatory lines was supplied by the British Thomson-Houston Co., Ltd., and that for the shearing lines by Metropolitan-Vickers Electrical Co., Ltd.



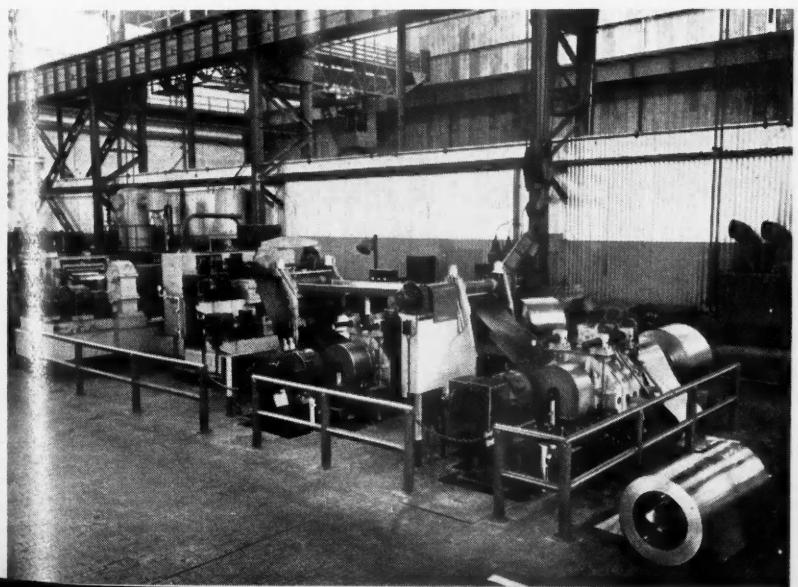
*Control of plating current is by means of vertical-spindle induction regulators*

The coil preparatory lines have a maximum speed of 1,800 ft/min and process coils up to 38in wide and of maximum weight 30,000 lb. From the pay-off reel, which is driven by a 30 h.p. 400/1,600 r.p.m. d.c. motor, the strip passes into a looping pit at a level adjusted by photo-electric equipment in the pit. It then passes on to the side trimmer, through manually operated side guides, where the edges are trimmed by rotary knives. The driving motor is a 40 h.p. 1,150/1,750 r.p.m. d.c. machine. The sheared scrap goes down a chute to the basement where it is fed into one of two scrap ballers, the ejected balls rolling to a storage area for shipment.

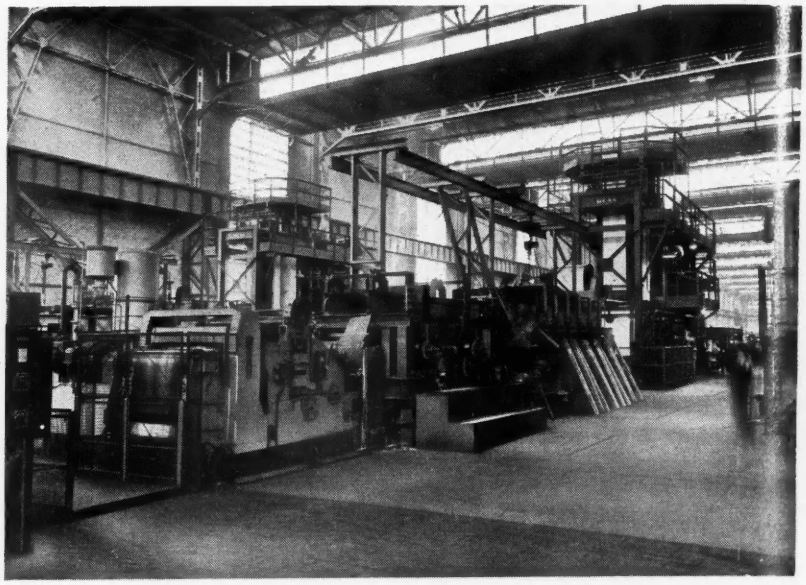
The end of the coil is now squared off and welded on to the tail end of the preceding coil after which it is fed by a pair of driven pinch rolls into the second looping pit. This pit is also equipped with photo-electric loop control. The strip then passes round a tension unit, the top and bottom tension bridle rolls being coupled to 25 kW and 50 kW drag generators respectively. The tension reel is driven by a 150 h.p. 300/1,200 r.p.m. motor. After weighing, the coils either go into stock or directly to the electrolytic tinning lines.

The shearing and classifying lines are capable of dealing with coils up to 30,000 lb at speeds up to 1,000 ft/min and cutting them into sheets from 18 to 37½in long. The feeding, pay-off and side-trimming arrangements are almost identical to those of the coil preparatory lines. Power is supplied to the main drives by a 0/150 kW 0/440 V generator driven by a 240 h.p.

*To avoid stoppages two pay-off reels are provided for each electrolytic tinning line*



1,460 r.p.m. 3·3 kV induction motor which is direct-on-line started. A 10 kW 230 V constant potential exciter, the uncoiler booster, and the classifier booster are also driven by the same motor. The uncoiler motor is a 30 h.p. 225/1,000 r.p.m. compensated machine supplied from the main generator through a booster. The side trimmer and shear are driven by two stability-wound motors of 30 and 75 h.p. respectively, connected direct to the main generator. The classifier conveyors are belt driven by seven small shunt-wound 850/1,700 r.p.m. motors, all of which are paralleled and connected in series with the classifier booster and main generator. The overall speed of the shearing and classifying line is controlled from the main generator on the Ward-Leonard system.



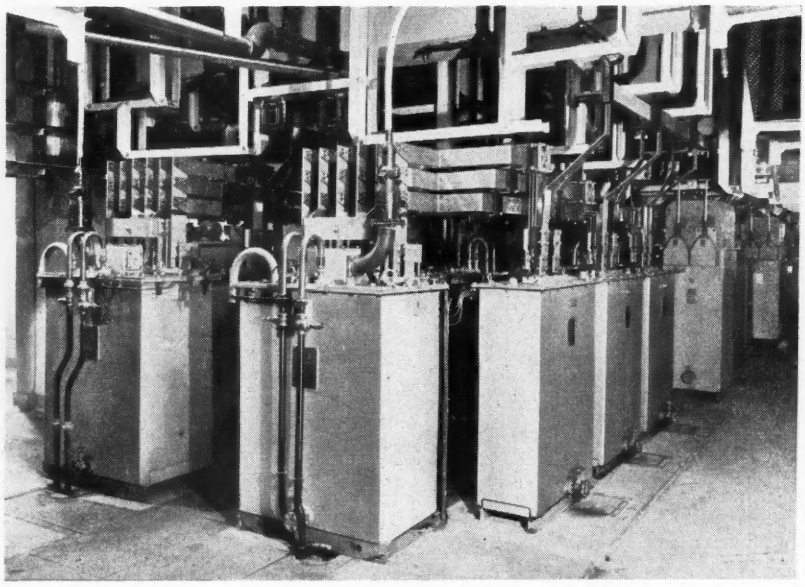
*General view of electrolytic tinning line showing the re-flow tower on the right*

For the hot-dip tinning of sheets the plant comprises nine two-way Head Wrightson lines of the most modern design, comprising an automatic feeder, electrolytic pickler, tinpot, wet washer, dry cleaner, inspection station, classifier and piler. Each line can give an average output of 4,500 basis boxes in a week of 126 hours when handling tinplates 28in square and of average gauge, the speed range available at the tinpot being 200 to 500 in per minute.

From the drive point of view, each line is divided into seven sections; the sheet feeder, tinning machine, dry cleaner, cross conveyor, menders conveyor, prime pile conveyor, and prime pile lift. The sheet feeder and tinning machine are driven by 4: 1 shunt field controlled d.c. motors, while the dry cleaner and prime pile lift are constant-speed a.c. drives. The remaining sections are driven by 2 : 1 shunt field controlled d.c. machines. The various drives for the auxiliary services are all constant-speed a.c. machines with direct-on-line starters. The electrolytic pickling equipment comprises essentially a transformer-fed 500 A 9 V rectifier arranged for on-load tap changing so that the intensity of pickling can be varied as required.

There are two Ferrostan electrolytic tinning lines at Trostre and each is capable of coating the coils in the continuous strip form at a maximum speed of 800 ft/min, the necessary Ward-Leonard drive being of American manufacture. To avoid stoppages two identical pay-off reels are provided, each coupled to a 10 h.p. d.c. machine which normally acts as a drag generator, but can also be used to jog the coil in either direction. The strip then passes through fibre pinch rolls each driven by a 5 h.p. 720 r.p.m. motor. These feed the strip to one of two sets of shears each driven by a 7·5 h.p. motor and after the ends have been squared off the pass lines from both pay-off reels converge and the trailing end of the preceding coil is welded to the leading end of the succeeding one in a travelling head seam welder operated from a 50 kVA transformer.

*These E.C.C. rectifiers supply d.c. up to 60,000 A at 16 V for plating*



Two rubber-covered pinch rolls driven by a 20 h.p. 850/1,700 r.p.m. d.c. motor feed the strip into an 80ft deep looping pit which is equipped with photo-electric loop control equipment. While in the pit, the strip is supported by rubber-covered pinch rolls, driven by a 10 h.p. d.c.

motor to form a double loop. Next comes the entry tension bridle which exerts the main back tension for the rest of the line and comprises a nest of rubber-covered rolls around and through which the strip is wrapped. Here there are a 10 kW and a 20 kW drag generators.

Cleaning is next done by passing the strip successively through three 9ft deep rubber-lined tanks and a "Tampico" brush machine driven by two 15 h.p. motors. In the first tank electrolytic degreasing takes place at 200 deg F and 100–150 A/sq ft in an alkaline detergent. In the second tank the carry-over of the detergent is removed by high-pressure sprays and brushes, while in the third electrolytic pickling is conducted in dilute $H_2SO_4$ with a similar current density to that in the first tank.

The plating section comprises five 9ft deep rubber-lined tanks and an additional one for drag-out recovery. The strip passes through the tanks guided by a sink roll near the bottom and a pair of conductor rolls arranged just above the top of each tank. These conductor rolls are fitted with eccentrically mounted slip-rings so that the brushes are kept moving in their boxes to avoid resistance at the low plating voltage used. Oil-immersed selenium rectifiers supplied by the Electric Construction Co., Ltd., provide the necessary d.c. for plating up to a maximum of 60,000 A at 16 V. A total of some 80 tons of copperwork was installed by British Insulated Callender's Construction Co., Ltd., to connect the rectifiers to the plating tanks. Control of the plating current is by E.C.C. vertical spindle induction regulators four of which vary the voltage between 1·6 and 16 V while a further ten trimming regulators give a fine control.

After leaving the drag-out tank the coating is flow-melted in a muffle furnace tower 27ft high. The strip forms one loop in the tower and passes beneath two conductor rolls at the bottom and two insulated transit rolls at the top. The current which flows through the strip via the conductor rolls is so adjusted that melting takes place only on the downward pass. The second conductor roll is immersed in water to quench the tin after melting. The strip then passes through a cathodic-anodic chemical treatment unit.

Next follows an 80 kV Wean electrostatic oiler, which gives the plate a very fine coating of cotton-seed oil. The strip then passes to the main drive bridle which pulls it through the cleaning, plating and post-plating zones. This has two 24in diameter rubber-covered rolls, driven by 40 h.p. and 60 h.p. motors, having speed ranges of 850/1,500 r.p.m., and a 19in diameter pneumatically operated hold-down roll. A carry-over conveyor then takes the strip to the shearing and classification line which is identical to that described earlier in the article. A rigid inspection is carried out on these lines: off gauge, pinholes and surface defects are automatically sorted into separate piles from the primes. There then remains only packaging and despatch.

# Engineering Drawing Practice

*Revised British Standard*

ANY progress towards universal drawing practice is of profound importance to engineers, and the publication by the British Standards Institution of a new and far more comprehensive edition of B.S. 308 is undoubtedly a milestone on the road towards a universal engineering language.

The new standard is divided into two parts. Section One (General Practice) is based on the previous B.S. 308: 1943, but while the section has been amplified in some respects, it has been considered advisable to confine the standard to recommended principles and methods to be followed in the preparation of engineering drawings. Subjects such as architectural drawings, survey plans, graphs, reproductions of drawings, and the nature and handling of drawing materials have been excluded, as such matters are more fully and appropriately dealt with in other British Standards. For these reasons it has been considered appropriate to alter the title of the standard from "Engineering Drawing Office Practice" to "Engineering Drawing Practice."

Section Two (Dimensioning and Tolerancing) is entirely new, and presents a great advance in the technique of drawing statement. It lays down a number of general principles, of which the most important are that the drawing should define the finished product as required by the designer, and that dimensions which affect the function of the product should be expressed directly on the drawing. It also deals with ways of indicating dimensions, tolerances and notes on drawings, and with the dimensioning of common features, including a special section on the difficult subject of tapers.

The latter portion of the standard is devoted mainly to the principles and methods of expression of geometrical tolerances for straightness, flatness, parallelism, squareness, angularity, symmetry, concentricity, roundness and position. By the judicious application of these methods, it will be possible in future to define precisely acceptable limits of geometrical form, instead of relying on individual judgment or conjecture. It must not be assumed, however, that it will always be necessary to apply the whole comprehensive system of tolerancing to every feature of every drawing. Such additional drawing statements will obviously increase drawing time and cost, and can only be justified if they are necessary to ensure essential accuracy and avoid waste of time and material in manufacture and maintenance. The geometrical accuracy of many common features (e.g., the concentricity of several diameters of a spindle turned or ground on centres) can often be assumed satisfactory as produced by ordinary or established methods. It therefore rests with the design organization to decide how far it is necessary to apply geometrical tolerancing in each particular instance, having regard to functional requirements, interchangeability and probable manufacturing circumstances.

The standard concludes with the dimensioning and tolerancing of profiles, and the indication of machining and surface finish. It is worthy of mention that the "tick" symbol ($\surd$) has been chosen to denote machining. It is also used as a vehicle for surface finish indication, and, as such, is already American standard practice. Canada and the International Organization for Standardization (I.S.O.)

are also likely to adopt it in the near future. The text is profusely illustrated by diagrams, and a number of typical drawings are appended to illustrate the principles and practices recommended.

This review would not be complete without some account of the progress which has been made in the international field. American–British–Canadian (A.B.C.) Conferences were held in Ottawa in 1950 and in New York in 1952, and a very real degree of mutual understanding on drawing practice has already been achieved. The standard soon to be published by the Canadian Standards Association will agree with B.S. 308 in its essentials, and Australia has also expressed the intention to follow it. Further, the American Standards Association has been working for more than a year on proposals for dimensioning and tolerancing inspired by the pioneer work in this country which has led to the publication of B.S. 308. In the Continental field, the British Committee has sent delegates to five I.S.O. Conferences on Drawing Practice, and although the treatment of geometrical tolerancing has not yet been agreed, many of the basic principles and practices of B.S. 308 have been adopted for inclusion in a proposed I.S.O. Standard. There can be no doubt, therefore, that much progress has been made towards the ideal of a universal drawing language which will enable many different countries to interpret each other's drawings with ease and confidence.

Engineering drawing is the main channel through which the ideas of a designer are communicated to the manufacturing organization, so it is a vital factor in the sound and economic production of engineering work. Thus it will be appreciated that the maximum benefit can only be obtained from this standard if it is generally adopted in British industry. Further, it is of the utmost importance that the standard should be accepted as a text-book in universities and technical colleges. An understanding of the basic language of engineering drawings should be recognized as a fundamental part of engineering education.

Copies of this standard are available from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 10s 6d.

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# Atomic Energy Research

## *Discussion on I.E.E. Papers*

THE discussion following three papers presented to the Institution of Electrical Engineers' Measurements Section on 5th January, and summarized in the *Electrical Review* of 8th January, was opened by Mr. E. H. Cooke-Yarborough (Atomic Energy Research Establishment, Harwell), who, referring to the paper dealing with the scaling unit, asked whether there were any reasons why, in principle, the single-pulse system should be faster than the two-pulse system.

With regard to intercoupling between scaling tubes with a suitable design of the trigger circuit a scaler could be designed in which every stage had the same values, but for the highest speeds the rectangular pulse was necessary and it was very difficult to obtain with gas triodes only.

Dr. H. A. Dell (Mullard Research Laboratories) said that the purpose of the neutron spectrometer was to make precise measurements of time to ensure that as many as possible of the errors due to misfiring and mistiming were eliminated. The primary source of the burst of neutrons was produced by a modulator consisting of an ignitron, which when used to control large inductive motor fields could be fired with quite low powers, but when precision was necessary it must have sufficient firing power to render its own breakdown of a non-random character. With powers of 100 kW or so, a random dispersion of 10 to 15 microseconds occurred in the time delay before main discharge was created.

With regard to the spectrometer itself, he and his co-workers did not use cathode follower tubes for pulse routing, but used blocking oscillators triggered by the pulse with which they were concerned, thus allowing the fitting of the necessarily extended cabling.

Mr. L. C. Burnett (Ericsson Telephones, Ltd.) referred to the statement by Mr. Kandiah that for reliable operation accurately defined pulses were used. If by " reliable " he meant a correct indication of count, other waveforms were equally good. If he meant to ensure reliable operation for a longer period of time, then he might agree with the author.

Mr. C. H. Tosswill (Mullard Research Laboratories), commenting on the significance of the input-signal to output-signal ratio of the tubes, said that the output signal could not be increased, but the input signal had two functions. It primed the next cathode to cause the breakdown in the desired direction and, secondly, extinguished the previous discharge so that only the new one remained active, but there seemed no reason why it should always do the second job. If the input signal were restricted to the first job, then the total input signal could be much smaller.

Dr. D. Taylor (A.E.R.E., Harwell) said that the standard counting equipment used in nuclear work consisted of a radiation detector, a pulse amplifier (usually the most elaborate and costly part), a pulse amplitude discriminator and a counting circuit. In the past most counting systems had used the orthodox type of pulse amplitude discriminator operating at a level of the order of 10 to 100 V. Mr. Kandiah offered something which would do an equivalent job at 100 mV or thereabouts. Therefore, if the pulse amplitude discriminator did all that Mr. Kandiah claimed, very much simpler and consequently less expensive counting equipment could be expected.

Mr. K. Kandiah replied that fundamentally a difference in the filling of the single-pulse tube made it faster. The faster tube was in fact used in the single-pulse system at a speed which was lower than would be possible if it were driven in the same way as the other tube.

The scope of the discriminator was difficult to see. It could be used satisfactorily at 100 mV in ordinary equipment. It could be used at a sensitivity of about 20 mV in equipment in which more care was possible in the design of the power unit. It might completely eliminate all pulse amplifiers except where extreme accuracy was required.

# Engineering in Europe

*Abstracts from Foreign Technical Journals*

In underground cables, as opposed to overhead line conductors, heat is generated in the cores, sheaths, armouring (if any), and in the insulation, of which the last may considerably increase with rising temperature. The dissipation of this heat represents a serious problem, particularly since there are great differences of opinion about the thermal conductivities or resistivities of the ground. These are reflected in differences in the values adopted by the regulations of various countries and even in the practice of individual firms. Obviously different soils may have widely differing characteristics in this respect, and cable erection in air, as practised in the United States, represents a different case altogether.

Normally, the last case is more unfavourable than bedding down in the ground, but if the thermal resistivity of the soil is high it becomes relatively more satisfactory. Furthermore, outside sources of heat and, generally, the average ambient temperature must be considered. Among the structural factors, conductor configuration and " densification " are as important as the type and service behaviour of the insulation. The dangers of cavities forming in filling compounds and the subsequent development of glow discharges in these are well-known, but they may be obviated by correct filling with a minimum amount of compound, so that the thermal expansions and contractions are rendered harmless.

Conditions in the case of stranded conductors are much improved by the use of wrappings of carbon black papers that smooth the conductor surface and act as semi-conductors which makes the field strength on the conductor surface more uniform. The author presents a comprehensive survey of these and allied problems, considering regulations and practice in various countries in " The Service Performance of Cables as Determined by their Structure and Method of Laying," G. Buss, *Elektrizitäts-wirtschaft*, Vol. 52, pp. 428–435, 1953, in German.

## Automatic Meter Testing

Apart from the stroboscopic method which can be applied only to special meter types, the calibration or control methods for meters conventionally used are either that of the wattmeter with constant load, or that of the standard meter with the same load as the tested meter. Both are awkward to use at the customers' premises, and require a skilled operator. This means that they are subjective, and not objective, methods. The author discusses more up-to-date methods, of which those using photo-cells and c.r.o.s have much to recommend them, although the bulkiness and cost of the apparatus are still prohibitive for their general use. However, a very simple and sound idea is to provide the counter with a built-in automatic switch (of negligible power consumption) which would, as it were, eliminate the " subjective " moment from meter testing by making and breaking the circuit always after a predetermined number of turns of the disc.

Alternatively, an automatized set of instruments controlled by relays and assembled in a handy case has been evolved comprising a standard meter with relays switching on and off within one turn of the meter disc, a recording instrument also providing the starting signal, and a standard wattmeter, this, too, switched on and off for exactly one turn of the disc. The last two solutions are economic propositions and will, without any doubt, be widely adopted in the near future.—" Automatic Testing of Electric Meters at the Consumers' Premises," A. Righi, *Elettrotecnica*, Vol. 40, No. 6, pp. 282–287, 1953, in Italian.

## System Voltage Distortion

An analysis of the distortions of system voltages and currents introduced by rectifiers is conveniently based on the case of a single-phase alternator supplying a non-linear impedance through a line. Since the alternator generates (in the ideal case) only the fundamental, it represents for any harmonic a short-circuit (except for the subtransient reactance). On the other hand, the non-linear impedance (rectifier) acting as a generator of a certain harmonic is loaded by an impedance which is the sum of the impedance of the line and the subtransient alternator impedance.

This consideration, together with the assumption of the capacitance of the line concentrated at its mid-point, and of half the line inductance concentrated at either end of it, leads to a suitable equivalent circuit for determining the distortions of the voltages and currents. This simple equivalent circuit can easily be refined and extended for the consideration of p-phase rectifiers. The author applies his method to calculating the harmonic content of a special rectifier circuit experimentally investigated by Kübler (*E.u.M.*, 1936, p. 39).—" Distortion of System Voltages and Currents by Mercury Rectifiers," B. Heller, *Elektrotech. Obzor*, Vol. 42, No. 6, pp. 304–308, 1953, in Czech.

## Surge Divertor with Arc Transfer

The surge divertor described is a horn gap with a non-linear resistance, of the type used in thyrite divertors, so inserted that a very small air gap remains (in other variants, two small air gaps). The phenomena occurring under an incoming current surge will differ according to the current intensity since the device behaves at small currents (up to a few hundred ampères) like a spark gap with a variable resistance in series, e.g., like a thyrite divertor, whereas high or long-lasting currents strongly ionize the surface of the resistance and thus produce within a short time an arc channel between the horns.

The two arcs thus formed unite and are drawn out by the well-known effect of the horn gap, so that they are quickly quenched. These effects are explained in more detail by considering the phenomena of current passage and distribution in semi-conductors and the distribution and distortion of equipotential surfaces and current filaments at a contact surface between a conductor and a semi-conductor.—" Surge Protection of Medium-Voltage Distribution Systems. Spark-Gap Surge Divertor with Arc Transfer," C. P. Ledoux, *Bull. Soc. Franc. Elect.*, Vol. 3, pp. 527–533, 1953, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

# The General Vector Diagram

## 2.—*Construction of General Vector Diagrams*

By M. G. SCROGGIE, B.Sc., M.I.E.E.

THE first article in this series (*Electrical Review*, 1st January, 1954), after setting forth the advantages of general vector diagrams by comparison with the usual kind, explained and (I hope) justified the voltage and current conventions recommended. These conventions can be most briefly expressed by reference to Figs. 4 and 8, repeated in this article as Fig. 13.

It is assumed that before starting on the vector diagram the circuit diagram has been drawn so as to avoid any cross-over. The first process then is to label all its junctions and meshes with letters or any other signs that may be convenient. The procedure thereafter depends on which data are known. It is analogous to that followed in stress diagrams for structures, and is best demonstrated by a simple example. Fig. 7, repeated here as Fig. 14, will do. Let it be supposed that the values of $R_1$, $R_2$, L and the generator e.m.f. are known, and that the requirement is to find the magnitudes and phases of all the currents and other voltages. (If it were merely desired to draw a diagram to show the general relationship without any particular values, as is often done for instructional purposes, one would follow the same procedure but without troubling to draw the lengths of the vectors to scale.)

### Current and Voltage Phasing

The starting point is the fact that the current through $R_1$ ($I_{AB}$) is in phase with the applied voltage. Since the order in which the current subscripts have been taken denotes (according to the recommended current convention) current through $R_1$ in the direction *b*-to-*c*, and the external voltage required to drive current in that direction is (according to recommended voltage convention) $V_{cb}$, this fact is represented by drawing the current vector AB parallel to the voltage vector *cb*, as in Fig. 15 (a). The positions and lengths of these vectors are quite arbitrary. Note that if the current had been called $I_{BA}$ the applied voltage would have been $V_{bc}$, and no change would have been necessary in Fig. 15 (a), but this alternative specification of the current and voltage would denote the contrary direction of the vectors.

The next fact derived from basic principles is that the currents through $R_2$ and L are together equal to $I_{AB}$, but $I_{CB}$ lags $I_{AC}$ by 90 deg, so the vectors CB and AC must be at right angles and equal to AB, which means that C must be on a circle with AB as the diameter. To indicate CB lagging AC, C must be in the upper semicircle. And AC : CB : : $\omega L$ : $R_2$. A geometrical construction for this is shown in Fig. 16. From any point C′, set off at right angles to one another C′A′ and C′B representing to any convenient scale $\omega L$ and $R_2$, respectively. Set off along BA′ (produced if necessary) a length BA equal to BA in Fig. 15. Drop a perpendicular from A to BC′, intersecting it at C. Then AC and BC are the correct lengths to transfer to Fig. 15 (b). Except for numerical solutions this construction is of course not needed; any position on the semicircle could be chosen for C, and in fact one would probably not even draw the semicircle but would use a 90 deg set square or the corner of a sheet of paper, or failing that judge the 90 deg by the eye.

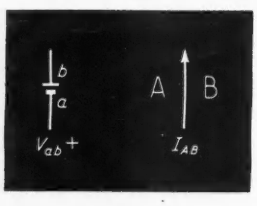


*Fig. 13.—Emblems indicating voltage and current conventions adopted*

The next fact is that the voltage driving $I_{AC}$ ($V_{ac}$) must be in phase with it, so a line must be drawn through *c* parallel to AC (Fig. 15 (b) ). The ratio of its length to *cb* must be equal to the ratio of the magnitude of the combined impedance of $R_2$ and *L* to $R_1$. Cs (perpendicular to AB in Fig. 16) represents this impedance to the same scale as CB represents $R_2$. So if the length Cs is set off from *c* along the new vector (Fig. 15 (c) ) and a length representing $R_1$ to the same scale as CB represents $R_2$ is set off along *cb*, the dotted line joining the ends of these lengths indicates the angle of *ba*, which can therefore be drawn parallel to it through *b*, fixing the point *a*.

After the dotted construction line has been rubbed out, the result is a general voltage and current vector diagram drawn to a scale on which *ab* represents the known e.m.f. of the generator, $V_{ab}$. To the same scale the lengths of *ac* and *cb* give the voltages $V_{ac}$ and $V_{cb}$, and their relative angles give their relative phases. $V_{cb}$, the drop across $R_1$, is seen to lag $V_{ab}$ by an angle equal to $\angle cba$. The scale of the current diagram is indicated by the fact that AB represents $V_{cb}/R_1$. The phase angle between the current through $R_2$ ($I_{AC}$) and the generator e.m.f. ($V_{ab}$) is equal to the angle between AC and *ab*, and that current is seen to lead the e.m.f.

The whole diagram is to be imagined as rotating *f* times per second anticlockwise. It is usual for the lengths of electrical vectors to be drawn to a scale representing r.m.s. values, but of course they equally well represent peak values to a scale $\sqrt{2}$ times smaller, and on that scale the vertical distance of any point on the voltage diagram above another denotes the instantaneous value of the voltage of the corresponding point on the circuit relative to the other, at a phase of the cycle that can be chosen by suitably orienting the diagram. For example, suppose one wants to know the potential of *c* with respect to *b* when the current flowing downwards through L (i.e., $I_{CB}$) is maximum positive. To represent this phase, turn the diagram to make the vector CB rise vertically. Then *c* is seen to be a little past its negative peak with respect to *b*; the actual voltage is represented by the line through *b* perpendicular to *ac* produced. And similarly for any other question. So long as the notation is strictly followed, there is no possibility of ambiguity or uncertainty about the sense of the vectors. They can be reckoned either way, as desired; the choice is not prejudiced by arrow heads. Reversing

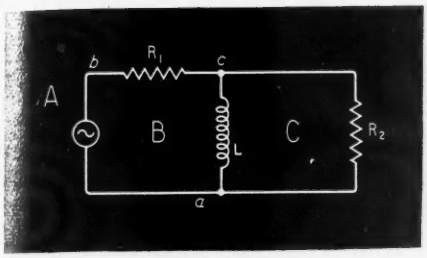


*Fig. 14.—Circuit taken as an example for fully-detailed construction of vector diagram*

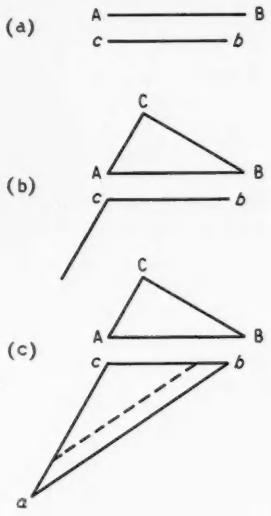


*Fig. 15 (right).—Successive stages in construction of general vector diagram for Fig. 14*

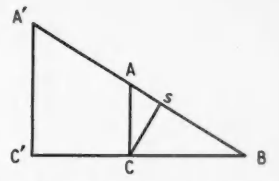


*Fig. 16.—Geometrical construction for drawing the current diagram in Fig. 15 (b) correctly to scale for numerical values*

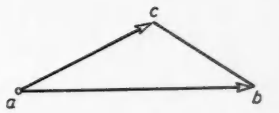


*Fig. 17.—In this derivation from the voltage diagram in Fig. 15 (c) the earthing of point a in Fig. 14 is indicated by making a the centre of rotation*

one vector automatically reverses all the rest. To set the diagram to represent the phase when the current *up* through L is at positive maximum it must be turned through 180 deg, and *c* is then seen to be a little past its maximum positive potential with respect to *b*.

It may be objected that the drawing of this diagram is a complicated, difficult and lengthy job, even for quite a simple circuit. To obtain the same numerical solution by any other graphical procedure, however, would necessitate quite as much work, and would not provide the same amount of information with such facility and absence of any need for thought to ensure correctness of relative phase. Naturally, if one is accustomed to different conventions, those demonstrated cannot at once be employed with equal speed. But when one does become used to them they can be handled as quickly as any other and with less fear of error. Most of the work in this example—and it was described in minute detail—was necessitated by the graphical determination of the numerical values; but in practice vector diagrams are mostly used qualitatively and can be sketched in a few moments. If the values are obtained by calculation, even a scale diagram is comparatively easy to draw.

## Does Not Supersede Other Forms

The other main criticism is that this type of vector diagram does not show relative phases so well as the usual sort, in which the vectors all radiate from a common point. Admittedly it is less easy to judge the relative angles of lines that do not intersect, and for accuracy a parallel rule should be used. But it must be emphasized that there is no suggestion that the general form of diagram ought to supersede all other kinds. What is claimed is that the general form has certain valuable uses, not the least of them being the basic form from which can be derived particular diagrams to suit particular conditions or assumptions.

Turning again to Fig. 14, suppose that point *a* is earthed or otherwise qualified to be the reference point with respect to which the potentials of all other parts of the circuit are reckoned. That means that its potential is regarded as fixed, so it is appropriate that point *a* in the voltage vector diagram should be made the fixed point around which the diagram is deemed to rotate. This fact can be indicated by drawing a small ring round the point, and if it gives one any joy, arrow heads can be drawn at the other extremities of the vectors, as in Fig. 17, where advantage is taken of the redrawing to set the e.m.f. at zero phase. (If preferred it could be set to 90 deg, positive maximum.)

But what about the vector *bc*? Since neither *b* nor *c* is earthed, neither is predestined as a reference point, and in the absence of any further information or intention it seems inappropriate to distinguish either end by an arrow head. For illustrating particular aspects of the circuit, however, one may go a step farther and convert it into one of the usual forms of vector diagram, of which a considerable

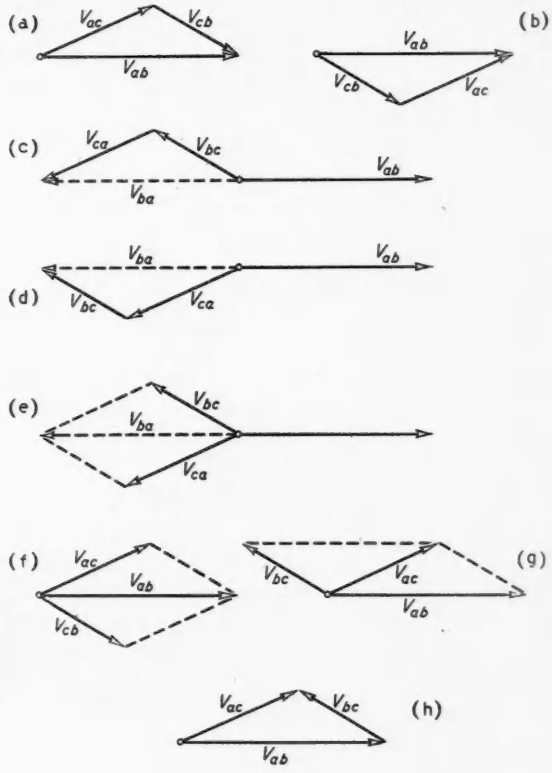


*Fig. 18.—Some of the ways in which the voltage vector diagram for Fig. 14 is commonly drawn*

variety exists, even in such a simple case; see Fig. 18. (To avoid confusion, the potential-rise convention for subscripts is continued, although probably many authorities would use the reverse.) One school of thought would favour variety (a), the point of view being that the voltages applied to $R_1$, and to $R_2$ and L, add up to equal the whole e.m.f., $V_{ab}$. But since the possibility of using a vector diagram to show the relative potentials of the points in the circuit is usually ignored, the diagram is just as likely to appear as at (b). Another school of thought shows the voltages across the impedances opposing the e.m.f., as at (c) or (d), or more probably as at (e), where the "completing the parallelogram" technique is adopted. Perhaps the most usual of all is this technique combined with the "applied voltage" philosophy, as at (f). Alternatively, if $R_1$ is the internal resistance of the generator and $R_2$ and L the load, it may be considered that the situation is best illustrated by (g), in which $V_{ac}$ is the available voltage, after $V_{bc}$ has been deducted from the e.m.f. Of course this could equally well be drawn as at (h). And if $R_1$ were the load and $R_2$ and L the internal impedance there would be two more varieties. But without them we already have eight, and have not begun to show currents, which would permit a whole crop of varieties for each one of these eight, depending on the convention adopted for direction of current!

## Definite Basic Form

Now for illustrating particular aspects of an electrical situation, some or all of these varieties may perhaps be justifiable. But is it not clearly desirable to have one definite basic form which includes all of them, is simpler and quicker (because it requires no voltage labels), and is free from the risk of confusion caused by some instructors favouring one of the varieties (a)–(h) and others favouring others? A student who had become accustomed to the (f) form might easily fail to recognize (b) or (e) or (g) as referring to the same thing. But why, you may ask, if variety is a danger, advocate yet another variety? The answer is that the proposed "variety" is really the basic form from which anyone who wishes can derive any or all of the others. And whereas not one of the varieties (a)–(h) enables the relative potentials of the circuit junctions to be seen at a glance, the recommended form does. And whereas it is a matter of opinion, custom, or practice which out of the eight varieties (a)–(h) is used, the simple triangle *abc* in Fig. 15 (c) is the *only* completely general form of the voltage vector diagram for the example given, and Fig. 17 is the *only* form for the same circuit when *a* has been chosen as or found to be the voltage reference point. In this simple circuit there is not likely to be uncertainty about whether any of the voltages is an e.m.f. or a voltage drop, but in more complicated diagrams by authors whose practice is not familiar one often has to study the situation closely before being quite sure which way a particular voltage is acting, and whether it is an applied e.m.f. or an e.m.f. of self-induction; from this, it is a relief to turn to the new form and know for certain that when *a* on the vector diagram is above *b* it means that *a* in the circuit is more positive than *b*. When the conventions are followed, this definite information comes automatically, without any particular thought having to be given to it.

Just a brief word about the current diagram. In the completely general form (Fig. 15 (c)) it is shown disconnected from the voltage diagram because there is no logical reason why they should be connected: doing so makes the voltage and current vectors more difficult to distinguish, and obscures the essential difference in nature between the two quantities. Points on the voltage diagram relate to circuit nodes, but points on the current diagram

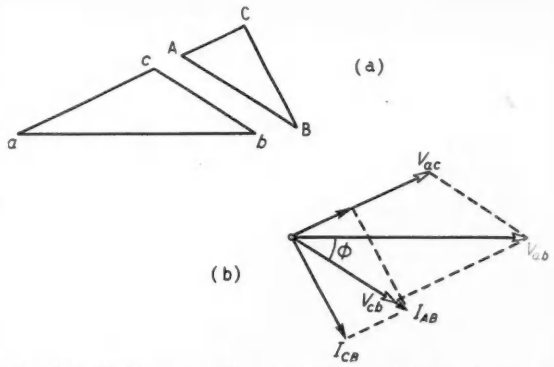


*Fig. 19.—(a) The completely general voltage and current diagrams (copied from Fig. 15 (c)), and (b) a combined diagram derived from it, arranged in conventional form to show the phase angles more clearly*

relate to circuit meshes. The only advantage of combining them is for ease in seeing and marking phase angles. It is admittedly very desirable to be able to label phase angles. The practice recommended, therefore, is to draw the general diagram as a basic reference, and then if necessary to supplement it by one or more derived diagrams, with the vectors shifted into the most suitable positions for comparing the important phase relationships or illustrating any particular aspect of the situation. Thus Fig. 19 shows, first, the general diagram; then, below, the same vectors rearranged in one of several possible ways to show phase angles more clearly. In this derived diagram the vectors must of course be labelled; and one's own pet arrow-head (or colour) code can helpfully be employed to distinguish currents from voltages, etc. Among the "etc." is flux, which so far has not been mentioned. Seeing that it is necessarily associated with current and is in phase with it, there seems to be no reason why it should not share the current notation, with resulting economy of system. Thus, in Fig. 14, the flux set up in the inductance L by current $I_{BC}$ can be referred to as $\Phi_{BC}$, and is in phase with it. When varying sinusoidally it generates an e.m.f. lagging by 90 deg. The current responsible for the flux is 90 deg behind the applied e.m.f., so the induced e.m.f. is 180 deg out of phase with the applied e.m.f. The convention therefore fits the physical facts.

That completes the exposition of the system, but in a further instalment some typical examples will be given.

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## Walsall Trolley-bus Bill

NEARLY all the neighbouring local authorities are likely to oppose some of the trolley-bus provisions in Walsall Corporation's Parliamentary Bill. It is understood that the adjacent councils fear that they will have less chance of objecting to future trolley-bus developments if the Bill becomes law in its present form. The main objection, it is understood, is to the special parliamentary procedure which the Corporation would be able to set in motion if the Bill is approved. The Corporation could apply for new routes to the Minister of Transport, who would have power to make an Order authorizing the use of trolley vehicles on roads inside or outside the borough. At present, all proposals for extensions to trolley-bus services have to be presented to Parliament in a special Bill. Although other local authorities would still be able to object to new routes within their boundaries, they feel that the provisions of the Bill are "heavily weighted" against the objecting authorities.

# Electrical Manufacturing–1953

*English Electric Co., Ltd.*

DURING 1953 the English Electric Co., Ltd., received many orders for steelworks electrification plant among which were two cold mill drives for the Ebbw Vale Works of Richard Thomas & Baldwins, Ltd. The first is for main drive electrification of a five-stand cold mill, rolling at speeds up to 5,000 ft/min, and the second is for a two-stand temper mill rolling at speeds up to 4,000 ft/min. An order was also received for a large twin drive (492 metre-tons) for a 190in plate mill in Scotland. Another order, for Spain, is for the complete electrification of a hot blooming and two structural mills.

Among jobs commissioned are a large reversing mill for Australia; a 17-stand rod mill, rolling at up to 3,000 ft/min in this country, and an 18-stand rod mill rolling at up to 4,000 ft/min, the supply to the machines being from rectifiers. A large push bench equipment, for making seamless steel tube, has been commissioned in Brazil, together with a large reversing mill (300 metre-tons) in Australia. A planetary hot strip mill which has been commissioned in this country is the only one of its type in Europe.

In the transformer department one of the first 120 MVA 275/132 kV transformers for the B.E.A. supergrid was commissioned at West Melton and orders were received from the B.E.A. for two 120 MVA 132 kV and one 106 MVA 275 kV generator transformers, these three units being among the first of their sizes to be ordered.

The previous year's "dollar drive" successes in the U.S.A. were followed by two further contracts for large 230 kV transformers. These are for the U.S. Army Corps of Engineers and the Bonneville Power Administration, covering three 310 MVA three-phase generator transformer banks and a 250 MVA three-phase transformer bank, respectively. Among the many other orders for large transformers were those for two 90 MVA 132/33 kV units for the B.E.A., and two 60 MVA 230/66 kV transformers for the Northern Rhodesia/Belgian Congo power development scheme.

The rectifier equipments commissioned during the year included two 1,650 kW sets for the Lancashire Steel Corporation, two 3,300 kW sets for the Consett Iron Co., and two 4,200 kW sets for the Bristol Aeroplane Co. Orders for steel-tank rectifiers, as used in the equipments mentioned above, include six 1,000 kW sets for the London Transport Executive, 1,500 kW 1,500 V equipments for the Victorian Railways, and three further 1,224 kW 1,530 V sets for the Netherlands Railways.

During the year orders were received for indoor and outdoor oil circuit breakers covering various ratings up to 88 kV for home and abroad. Oil circuit breakers commissioned covered various ratings up to 132 kV.

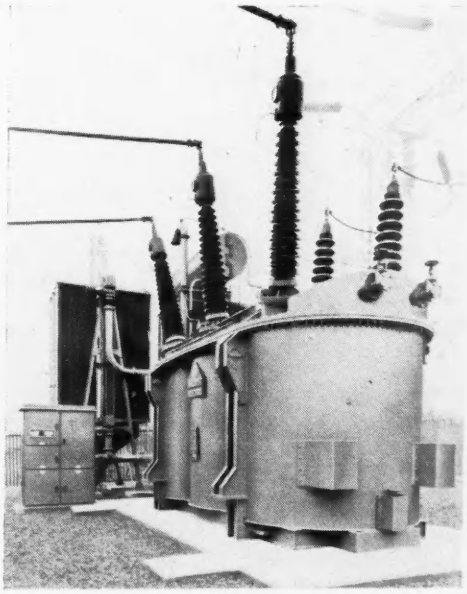
Air-blast circuit breaker orders included 66 kV, 115 kV and 132 kV ratings, the two outstanding orders being the nine-circuit 132 kV 3,500 MVA substation for the B.E.A. at Pyle, South Wales, and sixteen 115 kV 5,000 MVA circuit breakers for Canada. Numerous 132 kV and 165 kV breakers were dispatched during the year.

Turning to equipment put into service, the event of the year was the commissioning, at West Melton, of a 275 kV 7,500 MVA air-blast circuit breaker, connected in the line to Staythorpe. This breaker was installed in the substation by permission of the B.E.A., and has already carried out a number of switching operations.

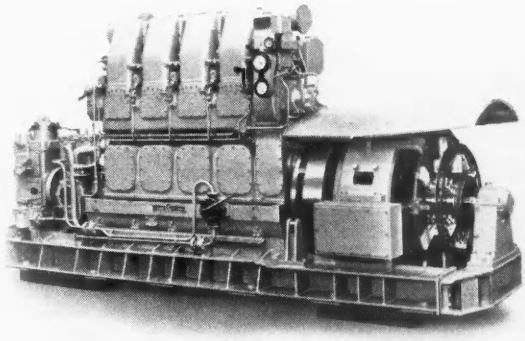
In the steam turbine field the orders received included five 60 MW sets for Marchwood and two 100 MW sets for Willington "A" power station. The 1,500 lb/sq in 1,050 deg F 60 MW sets for Stourport and Drakelow are well advanced in erection. In Canada, the third and fourth 66 MW sets were commissioned for the Hydro-Electric Power Commission of Ontario. Three of the ten 30 MW sets ordered for Vierfontein, South Africa, have been commissioned, and the fourth is ready for steam. The sixth unit has been shipped and the seventh is ready for dispatch.

A number of geared steam turbines of English Electric

*English Electric 120 MVA 275/132 kV three-phase 50 c/s ON/OFB auto-transformer at the B.E.A. West Melton substation*



*150 kW auxiliary generator set with air compressor for the Port Philip pilot vessel "Wyuna"*



design for the Navy's latest anti-submarine frigates are in course of manufacture by marine engine builders in this country. Following the development of a new design of electrical propulsion equipment, the company is engaged on a contract to supply a number of sets of this machinery for installation in British submarines.

Sea trials of the new Australian diesel-electric pilot vessel *Wyuna* were successfully completed last August; the propulsion and auxiliary machinery, including diesel engines and electrical equipment, were manufactured by the English Electric Co., Ltd. Various sets of diesel auxiliary machinery and electric motors are in hand for merchant ships and tankers, and diesel alternator sets for a bucket dredger.

## Hydro-Electric Plant

Typical orders for hydro-electric plant received during the year included water turbines for New Zealand and Canada. The arrangements for the Wayatinah development have been modified by the Tasmanian Hydro-Electric Commission. The power stations are now to have three 27,900 kW and three 12,750 kW sets respectively. Sets commissioned during the year included those at Gaur power station, Scotland, and El Picazo, in Spain. A further set at Salime, in Spain, is due for commissioning.

In December a contract for the manufacture and installation of two water wheel generators, ranking among the largest ever built, was awarded by the United States Army Corps of Engineers for the power station at the foot of McNary Dam, U.S.A. The maximum output of each generator will be 84,740 kVA at 13·8 kV, 60 c/s, 85·7 r.p.m.

Among the orders for diesel-electric traction equipment were 750 h.p. locomotives (Nigeria and S. Australia) and 400 h.p. power equipments for shunting locomotives (British Railways). Deliveries included 1,500 h.p. locomotives (Queensland) and 1,000 h.p. locomotives (Brazil), the mechanical parts for these being built by the Vulcan Foundry Co., Ltd.

Diesel-electric power equipments were supplied to British Railways (2,000 h.p. main line locomotive and 400 h.p. power equipments for shunting locomotives); complete 400 h.p. shunting locomotives went to the Netherlands Railways and to Imperial Chemical Industries, Ltd. Three 860 h.p. 6,600 V 50 c/s single-phase a.c. equipments were installed in the motor coaches operating on the Lancaster–Morecambe–Heysham section of British Railways.

During the year many orders were placed by textile machinery makers and users for electric drives and distribution equipment. In the jute industry, contracts were obtained from India and Pakistan, the latter covering the complete electrification of new factories. The drives supplied embraced all the processes, from the raw material to the finished sacking and hessian goods. Complete equipments covering distribution switchgear and transformers were included in the various contracts.

One order for the flax industry covered the electrical equipment of the new factory of the York Street Flax Co., Ltd., Belfast, and in the woollen and worsted industries orders were received for the electrification of two Yorkshire mills.

During the year large numbers of motors have been supplied to makers of looms and spinning machinery for jute, flax, woollen and worsted, and cotton mills. Among the many contracts covering motor drives for the cotton industry one of considerable interest is that for the electrification of cotton ginneries in Uganda.

Home and overseas orders for mine winders and haulages, with associated control gear, were received during the year. Home orders included equipment for the N.C.B. Although Ward-Leonard winders were included in the business, a characteristic feature was the number of geared a.c. winders, many equipped with d.c. dynamic braking.

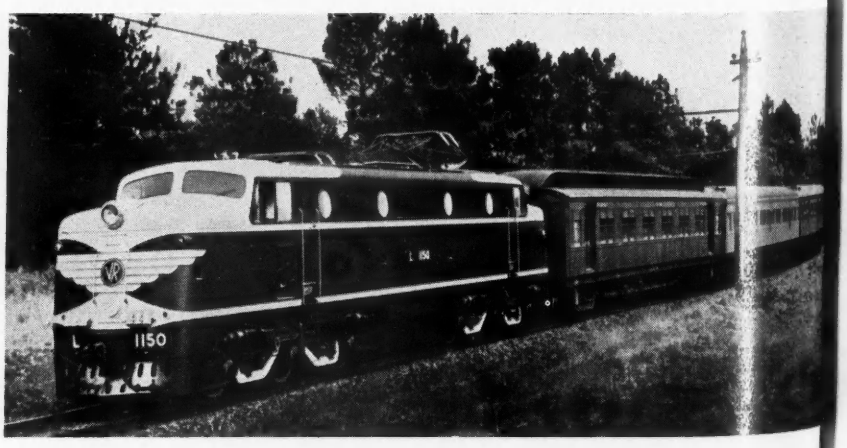
Several large contracts, in which electronic control plays a vital part, have been brought to a successful conclusion, while work started on new industrial projects.

The new bar rolling mill of the Parkgate Iron & Steel Co. was equipped with complete electronic control and it has already attained a record output of 70 tons a day. Standard controllers, with high speed accuracy, from f.h.p. to 100 h.p., continued in production, while a complete range of h.f. induction heaters has been developed.

The production of "C" type cores, for use in transformers and chokes for the electronics industry, increased considerably during the year, while the demand for distribution transformers for both home and overseas continued. An increasing number of orders was received for transformers with ratings and voltages up to 1,000 kVA and 11 kV, including units complying with British Electricity Specification T.1.

The company's range of electrical measuring instruments has been augmented during the year by the introduction of several new switchboard and portable models. In common with the rest of the range, they have been designed for maximum operating efficiency and reliability, fully conforming to British Standard and international specifications.

In addition to the new pattern ammeters and voltmeters, introduced last year, the company is undertaking contracts for the prompt delivery of wattmeters, varmeters, power factor indicators, frequency meters, synchroscopes, and tap position, temperature and speed indicators. They are available for flush or projection mounting with round or square dials, in both 6in and 8in cases and, in some instances, 4in cases can also be supplied.




*2,400 h.p. 1,500 V d.c. electric locomotive hauling a passenger train near East Ringwood, Victoria, N.S.W.*

# *VIEWS on the NEWS*

*By REFLECTOR*

THE *Observer* does not approve the recent reduction of purchase tax on electric heating appliances. It considers that the use of electricity for space heating is, " by and large," a wasteful way of converting coal into heat. Then, with that confusion of ideas exhibited so frequently by even the more serious newspapers, it suggests the raising of the domestic power rate at peak periods, " which would require changes in meters," or during the winter months. The writer is good enough to admit that " some inconvenience and unfairness would result," but says that " this ought not to weigh against the country's urgent need for fuel economy." It is a tribute to the effectiveness of anti-electric propaganda that even now the case for short-term electric heating and the fact that power stations burn coal unusable in any other way are so little thought of by Press commentators. And shall we never be able to explain to these people the different effects of plant shortage and coal shortage?

* * *

A story illustrating the resourcefulness of Sir Charles Parsons was told by Sir David Brunt, secretary of the Royal Society, when he presented Mr. H. Leyburn with the Parsons Memorial Lecture Medal at the I.E.E. last week. Sir Charles was renowned for overworking his motor car on the Northumberland moors. On one occasion the car came to a complete stop as the result of a bent axle. Parsons removed the axle, lit a fire on the moor, heated the axle and straightened it, using heavy stones as hammers, replaced it and drove home. Few modern owner-drivers could do as much as this.

* * *

When there is so much ado about the erection of overhead lines by public electricity authorities it is improbable that a private citizen could " get away " with it. A man at Moseley, Birmingham, could hardly have been aware of the applications, inquiries, and other proceedings which are necessary when recently he ran wires through a bedroom window to his car standing in the street outside his house. Although he pleaded guilty to erecting an overhead " line " without permission the magistrate exercised clemency and discharged him. Unfortunately the little neon lamp on the car was considered inadequate to meet the regulations and he was fined on this account. The magistrate supposed that if the wire had been laid on the ground no offence would have been committed but the prosecutor said that it might have caused an obstruction. This case recalls another, two or three years ago, in which a man was fined for running wires from a street lamp into his garage. In this instance, of course, the charge was theft of electricity and the fact that an unauthorized overhead line was erected seems to have been overlooked.

* * *

It is an axiom among American film producers that nothing in their productions must offend the political or religious susceptibilities of their heterogeneous audiences and the B.B.C. appears to be almost as cautious. There is a regular daily programme which introduces a kind of average middle-class family and, according to the *News Chronicle*, " the word has come down the labyrinthine corridors of the British Broadcasting Corporation: ' Mrs. Dale must not enter politics.' " The newspaper goes on to make some suggestions to ensure complete safety; one of them is that: " Mrs. Dale ought never to cook on a gas-stove, in case she upsets the British Electricity Authority." This recalls a comment I made two or three years ago on the television cooking demonstrations which then seemed to me to be a trifle too " gassy." Mr. Dale (of E.D.A.) took the matter up and since then, so far as I have seen them, these demonstrations have given electricity a fair show.

* * *

There are recognized occupational risks in the electricity supply industry against which precautions are taken. One which is not recognized was mentioned recently by Mr. T. Nolan, president of the National and Local Government Officers' Association, who himself is with the Yorkshire Electricity Board. He was referring to the free legal protection which the Association afforded its members and said that damages had been obtained in several instances, including a case in which an officer was assaulted by an irate customer in an electricity showroom. I am sure that Mr. Nolan's next remark, relating to the Benevolent and Orphan Fund, had no immediate connection with occurrences of this kind. If it had I can imagine the Association claiming " danger money " for its showroom members.

* * *

I cannot avoid the subject of fish; it keeps on cropping up in the news. On previous occasions I have mentioned how solicitous hydro-electric authorities are for the welfare of salmon although, I fear, this is not altogether humanitarian; the term " salmon rights " does not connote the rights of salmon. To enable the fish to get to their breeding waters, in spite of the intervention of hydro-electric dams, it has been customary to construct fish ladders—flights of broad stone steps. Now it is found that this takes too much out of the fish. At Pitlochry in Scotland, for instance, they have to climb 60ft in a distance of 900ft. So now a fish lift, similar to a canal lock, has been devised. It has already been tried out on the Liffey, near Dublin, and now the North of Scotland Board is installing one on the River Conon. The inventor of the device is Mr. J. H. T. Borland, of Glenfield & Kennedy.

* * *

At Cullompton (Devon) recently a transformer fault caused a sudden over-voltage on a housing estate. The *Tiverton Gazette* reports one lady, referring to the effect upon the lamps, as saying: " It was like the inside of heaven." This witness went on to say:—

> " I put the wireless on to get the correct time, but it roared and rattled and my husband told me to switch it off. As I did so I knocked a tooth out but I'm not sure how. Whether I got a shock or hit my mouth on the lid I don't know! "

This uncertainty robs electrical science of an interesting contribution.

# PERSONAL AND SOCIAL

*News of Men and Women of the Industry*

THE Council of the Institution of Electrical Engineers has elected **Mr. Ernest Leete** to honorary membership of the Institution for his outstanding services to the Institution, in particular for his services as honorary treasurer and as an ordinary member of Council over a period of almost a quarter of a century and also for his work on behalf of the Benevolent Fund. The Council has also made the thirty-second award of the Faraday Medal to **Mr. Isaac Shoenberg** for his distinguished work in electrical engineering, in particular the outstanding contributions which he has made to the development of high definition television in this country.

Mr. Leete first served as an ordinary member of Council of the Institution from 1925 to 1928 and subsequently served in a similar capacity from 1937 to 1940 and from 1943 to 1946. On three separate occasions he served the full period of three years as honorary treasurer from 1929 to 1932, 1940 to 1943 and again from 1946 to 1949. His services in this capacity have been particularly valuable to the Institution and it has not been overlooked that it was he who with two other members of Council evolved in 1939 a series of recommendations to the Council regarding the financial policy of the Institution which have formed the basis of the present financial security which it enjoys. Mr. Leete's interest in the activities of the Benevolent Fund has extended over some twenty years or more during ten of which, except for short periods, he served as deputy chairman of the Court of Governors. He was one of the prime movers in the inauguration of the Homes Fund for the development of " The Chesters " residential estate and the work involved in the planning and construction of the houses threw a heavy burden on his shoulders. He was appointed chairman of the Homes Committee on its inception in 1945.

Mr. Leete was born at Wallington, Surrey, in 1886 and was educated at Uppingham. In 1904 he accepted an appointment with the London Electric Wire Company and Smiths, Ltd., and was subsequently appointed secretary, secretary and director, managing director and consultant. He served as chairman of the Cable Makers' Association in 1928. He was first elected to membership of the I.E.E. in 1917 and was elected a companion in 1929.

Mr. E. Leete

Mr. I. Shoenberg

Mr. Shoenberg, who is director of Electric and Musical Industries, Ltd., led the team of scientists at E.M.I., Ltd., which developed the television system and its ancillary equipment which was adopted by the B.B.C. in 1936. This work involved the development not only of circuits but also of new types of electronic devices such as the cathode ray receiving tubes with modulated cathode stream and magnetic focusing and scanning. His development of the electronic picture tube known as the " Emitron " contributed perhaps more than any other single item to the success of the new system. Early in 1937 Mr. Shoenberg was able to offer the Post Office and the B.B.C. transmission equipment including special cables and repeaters which enabled scenes of the Coronation procession of King George VI to be televised. The great success of the television Coronation programme last year was to a considerable extent the result of Mr. Shoenberg's pioneering work and it was with this in mind that the Council of the Institution decided that it would be appropriate while thoughts of the Coronation were still fresh to award Mr. Shoenberg the Faraday Medal.

Mr. Shoenberg was born in Russia in 1880, where he received his early technical education. Subsequently he took post-graduate courses at the City and Guilds College and the Royal College of Science. After serving as chief engineer of the Russian Wireless Telegraph and Telephone Co., Petrograd (from 1905 to 1914), he came to this country to take up an appointment as consulting engineer to Marconi's Wireless Telegraph Co., Ltd., subsequently becoming head of the Patent Department and finally joint general manager of the company. In 1928 he was appointed joint general manager of the Columbia Graphophone Co., and in 1931 he went to E.M.I.

The presentations will be made on the occasion of the Kelvin Lecture on 29th April.

Following the delivery of the Parsons Memorial Lecture, 1953–54, by **Mr. H. Leyburn,** on the " Continuity of Electricity Supply " at a meeting of the Institution of Electrical Engineers on 7th January, Sir David Brunt, secretary of the Royal Society, proposed a vote of thanks to Mr. Leyburn and presented him with the commemorative bronze medal awarded to Parsons Memorial lecturers.

In our last issue we reported the appointment of **Mr. H. S. Smith,** London district labour relations officer, British Electricity Authority, as personnel officer to the London Electricity Board. We now reproduce his portrait herewith.

Mr. H. S. Smith

Mr. H. Faulkner

The Council of the Telecommunication Engineering and Manufacturing Association announces the appointment of **Mr. H. Faulkner,** C.M.G., B.Sc., M.I.E.E., F.I.R.E., as director of the Association. Mr. Faulkner was for forty years with the General Post Office, from which he recently retired as deputy engineer-in-chief.

Mr. Faulkner, who was born in Nottingham and studied at the University College there, entered the Post Office through the assistant engineers' open competition. After service with the R.E. Signals during the 1914–18 war, he was engaged in the establishment of the Rugby radio station. He had experience both at headquarters and in the field as superintending engineer in North Wales and deputy regional director. He became deputy engineer - in - chief in 1947. Mr. Faulkner has been chairman of the South Midland Centre of the I.E.E., and was until recently a member of the Council of the Institution.

**Mr. E. D. MaGuire** has been appointed chairman of Davidson & Co., Ltd., consequent upon the retirement of **Mr. Alfred A. Agar,** C.B.E.

The B.B.C. announces the appointment of **Mr. A. I. Bray,** B.Sc. (Eng.), A.C.G.I., A.M.I.E.E., as engineer-in-charge, television outside broadcasts (London). Mr. Bray joined the engineering staff of the B.B.C. in 1935 and was attached to the London outside broadcasts section. He transferred to television outside broadcasts in 1936. From 1940 to 1946 he served in the Royal Air Force and attained the rank

of squadron leader. Mr. Bray rejoined the B.B.C. early in 1946 in the Planning and Installation Department. He returned to television outside broadcasts later in the same year, where he remained and held a number of senior posts in the London section until taking up his present appointment.

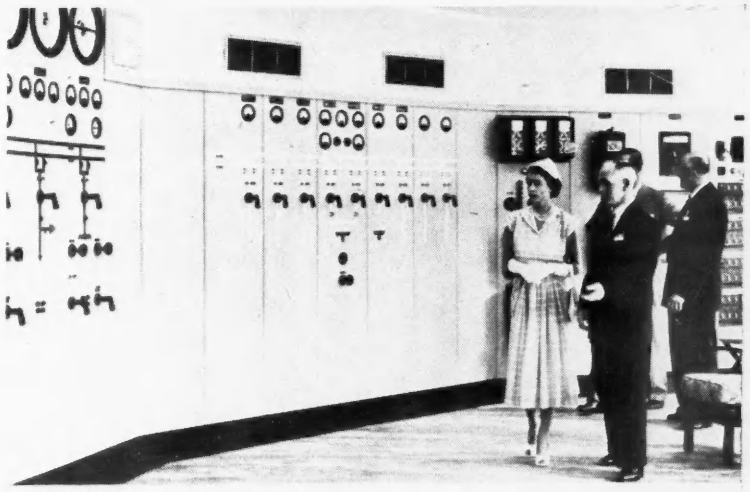
The United Steel Companies, Ltd., announces the following appointments: **Mr. K. Paterson,** director and chief engineer of the Appleby-Frodingham Steel Co., Ltd., will take up the appointment of general manager of the United Steel Structural Co., of which company **Mr. H. Saunders** will be commercial manager and director. **Mr. L. Gaskell,** chief electrical engineer, will become chief engineer to succeed Mr. Paterson, **Mr. W. E. Smith** is appointed chief electrical engineer, and **Mr. D. R. M. Nisbet** will be deputy chief electrical engineer. The appointments become effective on 1st April next.

Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., last week gave a dinner party for **Mr. Sidney Auger** and presented him with a cheque on his retirement at the age of seventy-three after fifty-three years' service with the company. Mr. Auger was for many years home counties sales manager and a specialist engineer in cement and paper manufacture. The

*Mr. S. Auger (left) receiving a cheque from Mr. J. B. Scott on his retirement from Crompton Parkinson, Ltd.*

party was held at the Washington Hotel, Curzon Street, London, W.1. In presenting the cheque from his fellow directors, Mr. Scott remarked that it was as a token of their appreciation and thanks for so many years of faithful service to the company. Mr. T. H. Windibank, director, also paid a tribute to Mr. Auger.

The D.C. Engineering Co., Ltd., has appointed **Mr. H. S. Redwood Burt** as manager of its Guildford branch office in succession to **Mr. A. E. Starkey,** recently appointed general manager of the company and who has now transferred to the London office. Mr. Burt, who will control the company's activities in Surrey and the adjoining areas, was, until recently, with Buchanan & Curwen, Ltd.



*The Queen showed great interest during her tour of New Zealand's hydro-electric schemes. Here she is seen in the control room at the Karapiro power station where she stopped on the way to Rotorua*

**Lt.-Col. D. H. Lewis,** R.A. (T.A.), until recently commanding officer of the 672 Heavy Anti-Aircraft Regiment (T.A.), was awarded the O.B.E. (Military Division) in the New Year Honours. He is a director of John Harper & Co., Ltd.

**Mr. R. A. Dawson,** for some years with the Marconi's Wireless Telegraph Co. aircraft establishment and at present production executive with Morphy-Richards, Ltd., is joining Remploy, Ltd., as production manager (electrical) with effect from 18th January.

Tube Investments, Ltd., has announced the appointment of **Major-General R. F. Belchem,** C.B., C.B.E., D.S.O., for special duties as a member of the personal staff of the chairman, Mr. Ivan Stedeford.

**Mr. J. R. T. White** has been appointed manager of the London area sales office of George Ellison, Ltd. Mr. White succeeds **Mr. E. P. Lucking,** M.I.E.E., who retires after forty-two years' service with the company.

Mr. White received his early training with the English Electric Co., Stafford, specializing in electrical switchgear and its uses, and later joined the switchgear technical staff of Johnson & Phillips, Ltd. In 1945 he took up an appointment on the electrical staff of the oil mills group of Unilever, Ltd., and in due course was promoted to chief electrical engineer of the United Kingdom oil mills of that company. Mr. White joined George Ellison, Ltd., in 1950 as deputy to Mr. Lucking.

Mr. Lucking was originally a development engineer for electrical switchgear and motor starters with the Adams Manufacturing Co. (now the Igranic Electric Co.) and later the General Electric Co., Ltd. In 1912 he joined George Ellison, Ltd., and in 1930 was appointed manager of the London area sales office. Mr. Lucking is to remain with the company in an advisory capacity.

**Mr. J. G. Fraser,** C.A., has been appointed secretary to George Ellison, Ltd., and the associated companies, Tufnol, Ltd., and Alfred Ellison, Ltd. He succeeds **Mr. R. Sawyer** who retires after forty-two years' service. Mr. Fraser was educated at the Edinburgh Academy, studied accountancy in the same city and is a member of the Scottish Institute of Chartered Accountants, having been admitted to the Edinburgh Society in 1936. After a period of service on the staff of Thomson McLintock & Co., London,

*Mr. J. R. T. White*

*Mr. J. G. Fraser*

*Mr. E. P. Lucking*

Mr. Fraser joined one of the subsidiary companies of Tube Investments, Ltd. Later he was appointed secretary to Associated London Properties, Ltd.

**Mr. G. F. N. Oliver,** managing director of Oliver Pell Control, Ltd., and a director of Varley Dry Accumulators, Ltd., was married on 19th December at Caxton Hall, to Miss Anne Vachell, of Cleeve, Somerset. The wedding reception was held at Brown's Hotel and the honeymoon is being spent in Madeira.

*Mr. G. F. N. Oliver and Mrs. Oliver*

**Mr. J. J. Cargill,** B.Sc., chief electrical and mechanical engineer to the North of Scotland Hydro-Electric Board, is due to retire in May next. He has agreed, at the Board's request, to continue to give his services in connection with the peat development scheme and wind-power and to act in an advisory capacity on other matters. **Mr. C. L. C. Allan** has been appointed to be chief electrical and mechanical engineer to the Board from the date of Mr. Cargill's retirement.

Mr. Cargill's first appointment was in the Electricity Department of Dundee Corporation and for many years he served the Scottish power group first as station superintendent at their Bonnybridge power station, later as assistant to the general manager of the Scottish Power Co., and ultimately as manager of the Grampian Electricity Supply Co. In connection with the peat development scheme, Mr. Cargill continues to be chairman of the Technical Sub-Committee of the Peat Development Committee of which Sir Edward Appleton is chairman.

Mr. Allan joined the Board's staff about a year after it started work and he has therefore been with the Board for about nine years. He is at present chief assistant to Mr. Cargill. He is a B.A. of Cambridge University and before joining the Board, he was successively with Balfour, Beatty & Co., Ltd., the Central Electricity Board, and the Electricity Department of Ipswich Corporation. He served his apprenticeship with Bruce Peebles & Co., Ltd.

**Mr. W. E. Warrilow,** M.I.E.E., F.J.I., who is 77 to-day, informs us that it is sixty years since he joined the electrical industry and fifty since he joined the I.E.E. Most of his time has been spent in various capacities, in technical, trade and national journalism. He retired at the end of 1946 but still keeps up an active interest in electrical affairs. His address is 24, Bath Hill Court, Bournemouth.

**Mr. C. H. West,** area sales manager for the Eastern half of England, for Smith Meters, Ltd., is to visit the Caribbean and South America, with a view to developing the market in that area. He left England on Wednesday last and will be away until about 17th May.

**Mr. V. Watlington** and **Mr. T. W. Heather** have been re-elected for the ninth year in succession as chairman and vice-chairman respectively of the Electrical Fair Trading Council.

**Mr. R. J. F. Howard,** chief engineer, and **Mr. S. Burr,** works manager, have joined the board of Lancashire Dynamo Electronic Products, Ltd., a company in the Lancashire Dynamo Group.

**Mr. T. W. J. Temple** has been appointed manager of the Middlesbrough office of the British Thomson-Houston Co., Ltd., to succeed **Mr. G. Lloyd Jones,** who is shortly taking up another appointment in the B.T.H. organization.

**Mr. W. M. Furniss** announced his resignation from the board of the Electric Construction Co., Ltd., on 31st December, at the age of eighty-three, following more than fifty years' service with the company. One of the early pioneers, he has had sixty-three years' association with the electrical industry. In the 1890's he was engaged in the development of electricity supplies in Ireland, especially in Carlow, Bray (Co. Wicklow), and Larne, the first generating plant for the Carlow undertaking being a 2,800 V alternator supplied by the company, then known as the Electric Construction Corporation, Ltd. Later Mr. Furniss turned his attention to the South Wales coalfields in the very early days of the application of electricity to coalmining.

He joined the Electric Construction Co., Ltd., in October, 1902, as sales engineer. One of his earliest assignments was the consultation for and finally the installation of the first electrical plant at the Cheddleton Paper Mills. He was appointed general manager of the company in 1915, joining the board in 1926 and becoming managing director in 1942. He combined that office with the chairmanship of the company in 1948, retaining both appointments until his retirement. Under the direction of Mr. Furniss the company added the manufacture of mercury-arc rectifiers to that of transformers.

The board of the company has appointed as chairman **Mr. Charles Reid,** D.S.O., M.A., C.A., who has been associated with the company for thirty-five years, originally as a partner of the company's auditors and, since 1944, as a director of the company. **Mr. W. M. B. Furniss** has been appointed managing director. He joined the company in 1925 as an indentured apprentice, and has held a number of positions up to assistant managing director.

**Mr. H. Cobden Turner,** managing director of Salford Electrical Instruments, Ltd., has been elected chairman of the North-West Region of the Engineering Industries' Association for a further term.

**Mr. J. E. Sunderland** has been appointed general manager of Enfield Cables, Ltd., and **Mr. M. J. Smith** has been appointed technical director.

The annual staff dinner of **F. Westerman (Wholesale), Ltd.,** of Birmingham, was held at the Grand Hotel on 2nd January. Smith's clocks were presented by Mrs. Westerman to seven members of the staff who during 1953 had completed seven years' service with the company. Mr. L. Maddox-Jones proposed the toast of the company, and Mr. H. E. Bagnall proposed the toast to the visitors, which was responded to by Mr. W. Parker of Monmore Conduits. Mr. F. Westerman said the company had had a good year.

A Christmas party was given on 2nd January by **M.K. Electric, Ltd.,** to 260 children of employees. After tea there was a programme of entertainment including films, a conjurer and a Punch and Judy show. The climax of the party was the entry of Santa Claus with presents.

## OBITUARY

**Lt.-Col. H. H. Vost,** whose death at the age of forty-seven we briefly reported in our last issue, was technical sales engineer in the North Midlands area for the Electric Construction Co., Ltd. Mr. Vost joined the company as an apprentice and on completion of his indentures was attached to the Sales Department, later becoming responsible for the North Midlands area. Early in 1939 he joined, as a lieutenant, the 4th A.A. Ordnance Workshops Company, T.A., and on formation of the R.E.M.E. he was promoted captain in charge of the Wednesfield workshops. Later he became senior ordnance mechanical engineer at 4th A.A. Division headquarters, Chester, and on promotion to lieut.-colonel he served at group headquarters at Preston. He was moved to the south of England to work on the A.A. defences against the German V1 and V2 missiles, and was demobilized in 1945 with the honorary rank of lieut.-colonel.

*The late Lt.-Col. H. H. Vost*

# Contracting Industry Dispute

## *Strike Action Started*

ON Wednesday last week the National Federated Electrical Association decided to "report" the dispute regarding wages with the Electrical Trades Union to the Minister of Labour under the Industrial Disputes Order. The Ministry had announced that it had been unable to persuade the parties to reach agreement on the claim for higher wages or on the reference of the claim to arbitration. Earlier the N.F.E.A. had offered an increase of 1½d an hour on condition that the rate for the first six hours of overtime was reduced from time and a half to time and a third. Certain coastal areas in the south were excluded from the offer.

The Union replied that it would be willing to resume negotiations if the proposed 1½d increase were made without conditions. Alternatively if the N.F.E.A. would grant an unconditional 1½d an hour the Union would agree that the question of a further increase should be the subject of arbitration. The Association declined to accept either of these alternatives.

At present the basic rate for a 44-hour week is £8 16s 0d in London and £7 17s 8d in the provinces. The employers' offer would raise these amounts to £9 1s 6d and £8 3s 2d respectively. The present average wage, inclusive of overtime, is stated to be £9 4s 4d a week. With the reduction of the overtime rate to time and a third payment for the first six hours would be reduced from £1 16s 0d to £1 13s 0d in London.

A statement by the N.F.E.A. upon its offer showed that about 80 per cent of the employees of Association members would receive the increase. The areas excluded had already received an increase of about 136 per cent over the pre-war rate, whereas in most other parts of the country the increase had averaged 123 per cent. The decrease in overtime rates would conform with the arrangements operating in many other industries.

The index of retail prices had risen by 40 per cent since June, 1947, but hourly wage rates in the industries had increased by 45 per cent in London and 43 per cent in the provinces.

On 7th January Mr. L. C. Penwill, director of the N.F.E.A., said that his Association had decided that for every day an operative was on strike no work would be available to him for a further day.

It was announced at the week-end that 260 electricians employed by F. H. Wheeler (Sheffield), Ltd., and W. H. Smith & Co. at the Appleby-Frodingham Steelworks, Scunthorpe, were hesitant about striking. Their case was that they had already lost three days' work during the strikes in August and September last. They considered that all future strikes called by the Union should be national and involve all sections of the industry. Mr. F. Foulkes, president of the E.T.U., addressed the men on Monday in order to secure their "co-operation." There were dissentients at the meeting, but it was later stated that the men would cease work on Tuesday and Wednesday. Mr. G. Cole, Union organizer, told the Scunthorpe men that if they were locked out they were not to go back until the Executive Council ordered them to. They would be paid the eight-hour day rate for each day they were out.

Apparently only three sites were affected on Monday—the atomic power establishment at Calder Hall, Cumberland, the Carmarthen Bay power station, and an R.A.F. station at Pembrey, Carmarthenshire.

A meeting of the West of Scotland Area Committee of the E.T.U. decided on Monday to participate in the 24-hour strike called for 18th January but not to take part in the sporadic strikes. About 3,000 men are involved. The E.C.A. of Scotland has advised its members not to take "reprisals" against them.

On Tuesday the Calder Hall men returned to work but another batch of 28 went on strike for an "indefinite period." About 120 men employed in London by Marryat & Place, Ltd., stopped work, among them being twelve engaged at the Lime Grove television studios.

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# Rural Electrification

SPEAKING on "Getting the Best Results from Barn Hay-Drying," at the three-day "school" on rural electrification organized by the British Electrical Development Association, Mr. W. L. Hearle, agricultural engineer, North Western Electricity Board, Manchester, said that where a suitable building was already available on the farm it had been shown to be both possible and practicable to make between 20 and 30 tons of hay with a crude protein analysis of 14 per cent by barn hay-drying with a capital expenditure of only £160, the running cost for drying being only of the order of £1 per ton.

Mr. J. T. Taylor, A.M.I.B.A.E., Bournemouth Sub-Area, Southern Electricity Board, read a paper on "Selling and Installing Grain Drying Plants," in which he said that the direct grain dryer now had serious competition in the in-silo and in-sack types, and a considerable increase in the number of installations had taken place in the last three or four years. Both of these types lent themselves admirably to all-electric operation.

On 5th January, Mr. M. M. Harvey, agricultural engineer, Midlands Electricity Board, Birmingham, spoke on "Selling Electric Steam Raising and Hot Water to the Farmer." To give some idea of the increasing appreciation of electricity by farmers, Mr. Harvey said that a census had shown that there were in this country 69,000 milking machines in use, 12,000 electric sterilizers, and over 24,000 mechanically refrigerated milk coolers. There were approximately 290,000 farms in England and Wales, of which 160,000 were dairy farms.

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# Electrical Industries Club

THERE was a gathering of about eighty at the first luncheon of the Electrical Industries Club held at the Connaught Rooms, London, on Tuesday, composed of founder members and their guests. After lunch Mr. A. B. Wildsmith, who presided, said that the Committee had pressed him to accept the chairmanship; the vice-chairman was Mr. R. Baldwin. Mr. Wildsmith said that it had been decided to adhere to a strict programme. The luncheon would be held at the Connaught Rooms on the second Tuesday of each month. It would begin at 1 p.m. promptly and at 2 p.m. there would be a break, when members would be free to go if they wished. Then there would be an address, lasting not longer than half-an-hour, by a prominent member of the industry.

Copies of the rules were available at the luncheon. These stipulate that membership of the Club should be open to male:—(*a*) principals, directors, or managers of any *bona fide* firm, company or supply authority in the electrical industry; (*b*) executives, whose main interest is in commercial trading, of any *bona fide* firm or company in the electrical industry; (*c*) persons of responsible standing in the electrical industry or closely connected with the interests thereof.

It has been decided that the entrance fee should be £1 1s and the annual subscription £2 2s. Particulars and membership forms can be obtained from the secretary, Mr. W. E. Babb, Kingsway House, Kingsway, W.C.2.

# Continuity of Supply

*The Parsons Memorial Lecture*

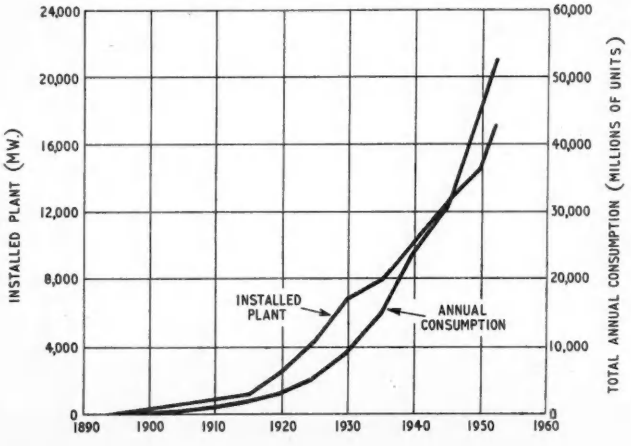
THE principal theme of the Parsons Memorial Lecture, which was delivered this year at the Institution of Electrical Engineers by Mr. H. Leyburn (A. Reyrolle & Co.) on 7th January, related to the causes and effects of faults on electricity supply systems and the means available for preventing interruptions of supply to consumers.

After discussing the layout of transmission networks generally, the lecturer examined some of the factors which contributed to failures of supply. Lightning, he said, even in this country, was responsible for about 40 per cent of faults on overhead lines and 20 per cent of all faults. It appeared that rising air currents due to temperature variations within a cloud carried positively charged water droplets to its top. These droplets then gave up their electrostatic charge and on freezing acquired a negative charge, which was carried by the heavier ice crystals to the lower layers, thus building up a potential difference between the cloud and earth until the critical breakdown gradient of air was exceeded and a small corona discharge called a " pilot streamer " was formed which zig-zagged to earth.

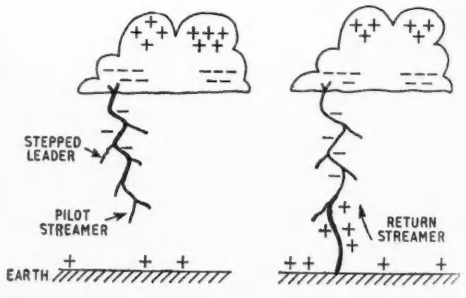
The ozonized path thus created was followed by a " stepped leader "—the first visible manifestation, the steps, being about 150ft long. When this reached the earth a bright high current " return streamer," constituting the characteristic lightning flash, travelled up to the cloud to neutralize the charge. Strokes to earth in 90 per cent of the cases were of negative polarity.

Over-voltages on an overhead line could be due to either direct or induced strokes. In either case the most important factors were the current magnitude and the wave shape of the discharge. Currents up to 100,000 A had been recorded; the average was 20,000 A. Wave shapes varied widely. For simulating surges in the laboratory a unidirectional impulse voltage having a shape of 1/50 microseconds was standard in Great Britain; i.e., the impulse voltage reached its maximum amplitude in one microsecond and then decreased to half the maximum in 50 microseconds.

The object of the earth wire was to intercept the leader stroke and thereby screen the conductors beneath it. If the resistance between a tower footing and earth were high, the result might be a back flashover from the tower across the insulators to the conductors. Another device was a surge divertor or arrestor, which consisted essentially of spark gaps in series with non-linear resistors connected between a phase conductor and earth close to the equipment it protected. When a surge amplitude exceeded the setting of the spark gap, the gap flashed over and the lightning current was discharged to earth through the

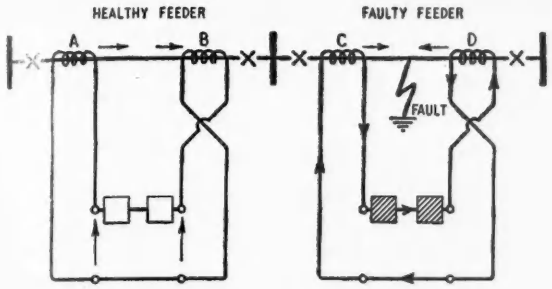



*Left : Installed plant and total annual consumption in Great Britain*




*Mechanism of a lightning stroke:* (a) *Initiation of stroke;* (b) *discharge along ionized path*

*Multiple stroke to the Empire State Building, New York City: the lower photograph gives the picture of the stroke to the unaided eye and the upper photograph depicts the sequence of multiple discharges comprising the stroke; total time 0·6 second. [Reproduced from " Protection of Transmission Systems Against Lightning " with acknowledgment to John Wiley & Sons, Inc.]*




*Balanced feeder protection using pilot wires*

resistor, leaving a much reduced discharge voltage to be impressed on the equipment. Other lightning protection devices were co-ordinating arc gaps, arc suppression coils and automatically reclosed circuit breakers.

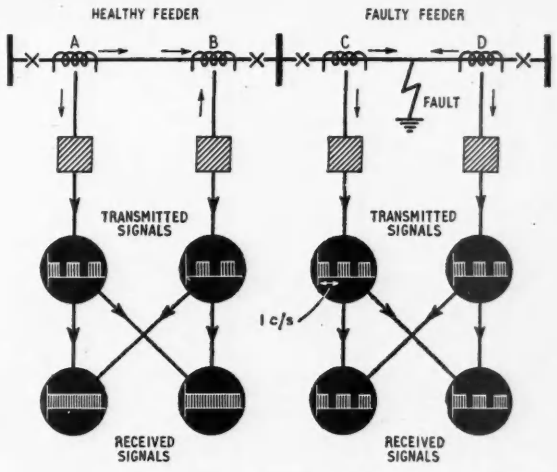
Insulation failure from flashover of overhead line insulators due to fog and salt spray had been greatly reduced through the use of anti-fog insulators having a high creepage distance between the live terminal and earthed metalwork. Failure of solid insulation was exemplified by the thermal effects of small capacity currents which flowed in dielectrics.

The general level of insulation of a system must provide against flashover or breakdown at the highest "internally generated voltage" (as distinct from external lightning effects). The maximum voltage of this kind was produced by the switching off of a highly inductive or capacitative circuit and depended largely on the constants of the circuit; the switching voltage should not be more than three or four times the normal.

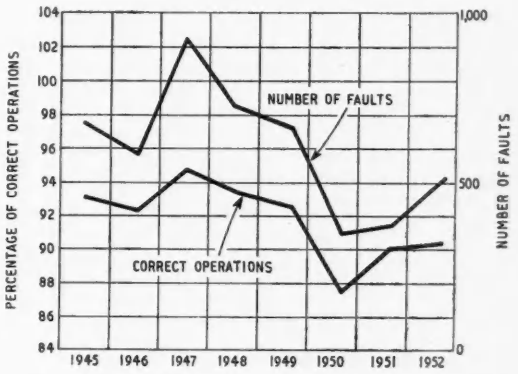
Insulation levels were next allocated to different apparatus. For example the voltage for air flashover would be less than that which would more harmfully puncture solid insulation. A co-ordinating gap with a relatively low flashover setting might be connected between the phase conductors and earth where it would be least harmful to continuity of supply. The tendency nowadays was to base insulation levels on unidirectional impulse voltages approximating to lightning surges rather than on power frequency voltages as formerly.

Turning to methods of clearing faults, the lecturer defined their duties as, first, to minimize damage by the fault at its location, secondly to prevent damage to healthy equipment and thirdly to avoid instability of the power system. With increasing concentrations of power and interconnection of generating stations the times allowable for protective systems and circuit breakers to operate had decreased, and total clearance times of 0·2 sec or less were now usual. These times would have to be reduced where system instability was likely through the high reactance of lines interconnecting power stations or the magnitude of load transmitted. Thus in Sweden where the interconnectors were over 600 miles long a clearance time of 0·08 sec was claimed.

Discrimination in a protective system meant that it would operate for a fault in the equipment it protected but not when fault current passed through such equipment to a fault elsewhere. "Balanced" feeder protection depended upon a balance, in phase and in magnitude, between current entering and leaving a feeder by comparing the outputs of similar current transformers, connected by pilot wires, at each end of the feeder, any difference due to a fault causing associated relays to open the circuit breakers. This type was used for cable networks and short overhead lines, but the cost of pilots precluded its adoption for longer lines.




*Phase comparison protection*




*Performance of protective systems on British grid—1945/52*

In a second system described the phase relation between the currents at the two ends of a feeder was compared. Signals were transmitted from end to end on every alternate half-cycle of a fault current. Relays, usually electronic, at each end also received a similar signal from fault current flowing locally. Signalling was continuous for through faults and so did not operate the relay, but discontinuous for internal faults, thereby opening the associated circuit breaker. Carrier currents, superimposed on the protected line at frequencies of 80 to 500 kc/s formed the channel of communication.

A third protective system, the time-distance, differed from the previous two in that its stability was not entirely independent of conditions in adjacent feeders. This introduced several difficulties, which however had been overcome in practice.

Circuit breakers were of three basic types, namely oil filled, air-blast and air-break and were now being made in Great Britain to interrupt 7,500 MVA at 275 kV. The different means adopted for arc extinction in each case were discussed. For the heaviest duties the air-blast type possessed the advantage of being easily constructed as a number of units in series, thus facilitating testing, alternative procedures in which were described. Testing entailed more than proving high short-circuit ratings, since the interruption of comparatively small reactive or capacitative currents might be even more onerous.

# INDUSTRIAL NEWS

## An American Protest

WE REPORTED IN our 25th December issue that the English Electric Co. had been awarded a contract by the United States Army Corps of Engineers for two 84,740 kVA hydro-electric generators to be installed at the McNary Dam on the Columbia River. The company's quotation (about £1,300,000) was the lowest received. The next lowest (about £1,500,000) was that of the American General Electric Co., which has now protested against the award of the contract to the English Electric Co.

In asking the U.S. Army authorities to award the contract to itself the General Electric says that the giving of the work to the English company would result in a loss to the United States of tax to the amount of $1,159,000 and a million man-hours of work.

## New G.E.C. Blackburn Premises

On 6th January the Mayor of Blackburn, Councillor R. Weir, J.P., opened the new Blackburn premises of the General Electric Co., Ltd., in Mincing Lane. The opening ceremony was attended by Mr. Leslie Gamage, M.C., vice-chairman and joint managing director, and many friends of the G.E.C. in the area.

The first G.E.C. branch in the town was opened in 1931. The manager was Mr. H. W. Roberts, who has now presided over its fortunes for twenty-two years. With the expansion of staff and facilities the original premises in Darwen Street were by the middle 1930's inadequate and stores were acquired in Weir Street. The new Magnet House in Mincing Lane, which is twice as large as both previous premises put together, affords approximately 12,000 sq ft of working floor space. The building has been completely redesigned and particular attention has been given to the arrangement of counter stocks to give quick, efficient service to the trade counter.

Visitors on the opening day were shown round an exhibition on the second floor. All offices and stockrooms in the building are lit by fluorescent and tungsten fittings and the building is electrically heated. The Reliance Telephone Co., Ltd., supplied the internal intercommunication system. The electrical contractors were Messrs. F. F. Riding, of Blackburn.

At a luncheon which followed the opening ceremony, Mr. Gamage said that when the G.E.C. first went to Blackburn it was the first of the major electrical manufacturing companies to open a sales office in the town. Its intention was to develop the electrical trade amongst the textile firms in that part of Lancashire. The power station at Huncoat was completely equipped with G.E.C. generating plant. The company's association with Lancashire began over sixty years ago, for the first works of the company were opened in Chapel Street, Manchester, in 1888. To-day some of its most important works organizations were situated in the county.

## Engineering Industry Wages

The dual Court of Inquiry appointed by the Minister of Labour to investigate the claim of the Confederation of Shipbuilding and Engineering Unions for a 15 per cent increase in the wages of members of the constituent unions met for the first time on Friday last week. Lord Morris, the chairman, asked the parties to the dispute to prepare statements regarding wage negotiations over the past fifteen years and asked to see the principal agreements governing the existing wage structure and payment for overtime.

The Court then adjourned until Tuesday last when it proceeded to hear evidence from the parties.

## Darwins' Acquisition

Following the repeal of the Iron and Steel Act, 1949, and the dissolution of the Iron and Steel Corporation of Great Britain, the Darwins group board of directors has announced the acquisition of the whole of the share capital of the Sheffield Forge and Rolling Mills Co., Ltd. This company will continue to trade under its usual title.

The Darwins group has installed a new basic arc furnace at Andrews Toledo, Ltd.

## Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

| | |
|---|---|
| ALUMINIUM Ingots | ton £156 0s 0d |
| COPPER, H.C. Electro | ton £230 10s 0d |
| Fire Refined 99·70% | ton £229 0s 0d |
| Fire Refined 99·50% | ton £228 0s 0d |
| COPPER Tubes .. | lb 2s 2¾d |
| Sheet .. .. .. | ton £289 10s 0d |
| H.C. wire and strip | ton £261 0s 0d |
| LEAD, English .. | ton £89 15s 0d |
| Foreign .. .. | ton £88 0s 0d |
| MERCURY .. .. | flask £61 15s 0d |
| TIN, block (English) .. | ton £657 10s 0d |
| ZINC, G.O.B. Foreign | ton £73 0s 0d |
| Electrolytic .. .. | ton £74 15s 0d |
| BRASS Tubes (solid drawn) .. .. .. | lb 1s 9⅝d |
| Sheet .. .. .. | ton £236 10s 0d |
| Wire .. .. .. | lb 2s 5½d |
| PHOSPHOR BRONZE Wire .. .. .. | lb 3s 7¾d |
| PLATINUM .. .. | oz £27 0s 0d |
| RUBBER, No. 1 R.S.S. spot .. .. .. | lb 16⅞d–17⅛d |

*The Mayor, Councillor R. Weir, J.P., opening the new G.E.C. showrooms at Blackburn. Mr. Leslie Gamage is seen immediately behind the Mayor*

## Lifts for the L.C.C.

A bulk order for 150 lifts, worth £329,600, for residential flats which are being built in the London Area, has been awarded to the Express Lift Co., Ltd., by the London County Council, and was secured in the face of severe competition. It is believed to be the largest lift order ever placed in this country, both as regards the number of lifts involved and the aggregate value. The company, which has now received orders for well over a thousand lifts of this type for municipal authorities in England and

overseas, has previously had from the L.C.C. three bulk orders for 100 lifts each.

The lifts now ordered have a carrying capacity of 1,200 lb (eight persons) and are push-button controlled by the passengers. The cars are designed for the easy handling of perambulators, and the car doors and landing doors open and close electrically. The doors are fitted with sensitive safety devices and reverse immediately if they should meet with any obstruction when closing. Doors of this type ensure a high degree of safety to passengers—many of whom are children. The cars and entrances are constructed of fluted aluminium with a natural finish, and special precautions are taken to minimize the results of misuse and malicious damage.

The complete lift equipment will be manufactured throughout at Abbey Works, Northampton, with the exception only of the tee steel guides and the steel wire ropes which are specialist items and the electric motors which will be made at the Witton Works of the parent company, the G.E.C.

## Factory Equipment Exhibition

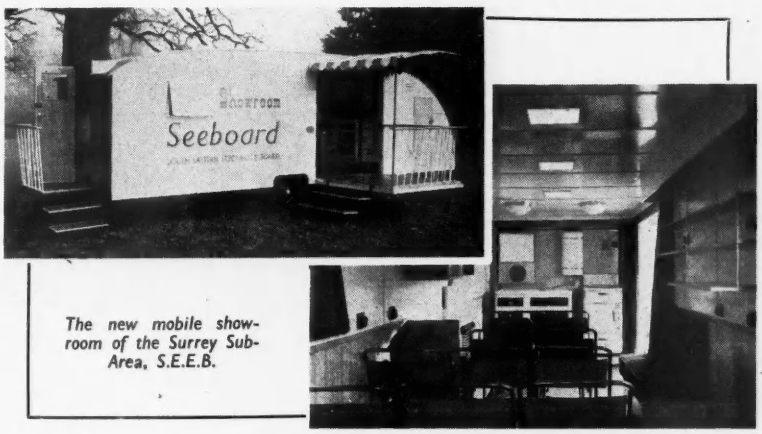
Over 100 exhibitors from all parts of Great Britain have booked space for the second National Factory Equipment Exhibition, to be held at the Horticultural Halls, Vincent Square, and Greycoat Street, Westminster, London, from 22nd to 26th March next. Lord Rochdale, President of the National Union of Manufacturers, will open the exhibition. The Duke of Edinburgh, who visited the first National Factory Equipment Exhibition last year, has consented to become its patron for 1954.

## Mobile Showroom

The Surrey Sub-Area of the South Eastern Electricity Board has recently put into service a mobile showroom. Although the fourth to be purchased by the Board for improving services to consumers, it incorporates a number of unusual features to provide facilities for cooking and home laundry demonstrations, film shows, and for the payment of accounts. It can also be equipped as a model kitchen or used as a mobile showroom for general sales.

The design is basically a standard Berkeley Grosvenor shell with a special extended steel chassis to carry the additional weight of the kitchen equipment. The normal length of the van is 20ft, but a retractable extending end provides an additional 6ft when the van is in use, thus giving a total floor area of 182 sq ft and providing demonstration seating accommodation for about 16 people. A sink unit and fixing and wiring for a demonstration cooker and washing machine are mounted on a sliding platform which is normally carried in the main section of the van but slides back into the extension for demonstration purposes, thus giving maximum seating accommodation.

A Derry's "New Look" water heater is mounted over the sink underneath which there is a 25-gallon storage tank for waste water. The water heater and sink unit are fed from a 20-gallon water storage tank at the rear of the van by means of an electric pump. A cinema screen and loudspeaker equipment are included and are designed for back projection from equipment mounted in the extension. Other features include fitted glass showcases, a folding cash desk, fluorescent lighting, a built-in "Thermovent" heater and "Dunlopillo" seat over wheel arches. A drop down door in the side of the van ensures easy entry and provides a 6ft by 6ft demonstration platform for outside demonstrations in fine weather. There are also an additional rear entrance door and side entrance to the extended end, to provide access behind the demonstration platform for the projector operator.




*The new mobile showroom of the Surrey Sub-Area, S.E.E.B.*

## Manufacturing in India

In its first year's operation (up to September last) the Licensing Committee set up under the Indian Industries (Development and Regulation) Act considered 226 applications for licences for the establishment of new industrial undertakings or the extension of existing ones. In 181 cases (reports *Indian Trade and Industry*) licences were granted; among these were eleven relating to machinery and equipment for the generation, transmission, etc., of electric power.

The same journal reports that India's telephone cable factory is expected to go into production next month. At present the whole of India's requirements of dry-core paper-insulated telephone cables are met by imports. The value of cables required by the Posts and Telegraphs Department is about Rs 8 million a year.

## Mining Regulations

The 1953 edition of Regulations and Orders relating to Safety and Health under the Coal Mines Act, 1911, has been issued by the Ministry of Fuel and Power (H.M. Stationery Office, 4s). Statutory requirements in force at the end of 1952 are listed in chronological order. Electricity Regulations occupy about ten of the total of 262 pages and reference is made to the relevant explanatory memorandum (M & Q Form No. 11). In addition references to lighting include the provisions that govern the use of electric lighting from an external source, the prescribed standard of performance of electric cap and other lamps with krypton and argon filled bulbs and the manner of marking lamp bulbs. Telephones and signalling apparatus are covered in other sections. Under the heading of statutory certificates of mining qualifications particulars are given of the degree of electrical knowledge required of candidates.

## Transformers for Cape Town

The Cape Town City Council has awarded the Brush Electrical Engineering Co. a contract for two 30,000 kVA power transformers. Twenty-seven offers were made by firms in Britain, the United States, Germany, Italy, Austria and Belgium. The lowest was that of £43,920 from the German A.E.G. The Brush quotation, the ninth from the lowest, was £60,480. The Council's engineers advised that Continental transformers were in general inferior in design and construction to those of British manufacture.

## Turkish Power Contracts

After a reference to the 60 MW extension of the Catalagzi power station, which is being carried out by the Metropolitan-Vickers Electrical Co., Babcock & Wilcox, Ltd., and other British concerns, the *Monthly Trade Journal* of the British Chamber of Commerce in Turkey for December reports the award of a contract for a new power station to the German A.E.G. group. This station, at Tunebilek, in the Konya area, will have a capacity of 60 MW and is to be completed in two years. The value of the order is said to be "rather less than £T22 million" and the contractors are giving six years' credit. The plant is

to be steam driven, the fuel being low quality lignite from the Zonguldak washeries.

So far as is known, says the *Journal*, no British companies entered tenders for this contract, the other firms concerned being the German Siemens, Borsig and M.A.N. concerns, two French groups (Schneider and G.T.M.) and two Belgian companies. The Austrian firm of Pauker also entered a tender but as no credit facilities were offered it did not receive serious consideration.

It is stated that the offers ranged from £T20 million to £T34 million, credit periods from five to seven and three-quarters years and delivery periods from 24 to 33 months.

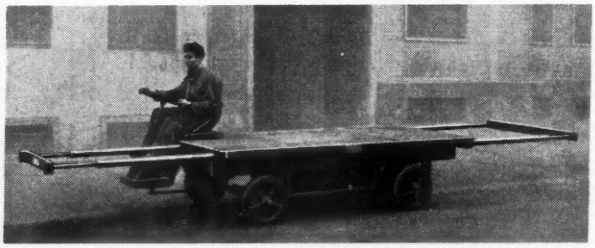
In a further note, on trade with Italy, the *Journal* says it is expected that an Italian company will receive the order for transformers for the Seyhan power station.

## Novel Battery-Electric Truck

The latest four-wheeled battery-electric truck of the Italian Turrinelli Co. can carry up to 6 tons on good roads and is highly manœuvrable. Apart from this the carrying platform can be extended from its normal length up to about 20 ft as shown in the accompanying illustration. With an overhang of 5ft at either end, this allows piping, etc., up to about 30ft long to be carried.

The speed of the truck is 1·86 to 3·72 m.p.h. depending on the load carried, while its range with a medium load is between 21 and 25 miles with a 130 Ah battery. The motor is a 2·5 h.p. 80 V machine which drives the rear wheels through double reduction and differential gearing. Control is by a pedal-operated segment controller.

The vehicle is of fabricated construction with a fixed sheet iron carrying platform 4ft 10½in wide by 9ft 9in long.



*Italian battery-electric truck*

## Public Speaking Competition

The first of the 1954 E.D.A. Public Speaking Competition area contests will be held at the Lighting Service Bureau, 2, Savoy Hill, London, on 19th January. Nine candidates have entered in the London area for the men's group—eight from the London Electricity Board and one from the London Division, B.E.A. In the afternoon there will be a joint contest by six women candidates from the London, South Eastern and Southern Electricity Boards. The subjects on which the competitors are to speak are: "Life without Electricity," "The Place of Electricity in the National Economy," and "The Housewife in the Reigns of the two Elizabeths."

## Turbo-Alternator for N.P.L.

The General Electric Co., Ltd., has received an order from the Ministry of Works for a back-pressure turbine driving a 650 kW (c.m.r.) alternator, to be installed at the National Physical Laboratory, Teddington. This machine is required to work in parallel with the public electricity supply; the exhaust steam will be used for a central heating system serving all the laboratory buildings, replacing the present system by which each building is separately heated.

Steam generated in three 13,000 lb/hr oil-fired boilers is supplied to the turbine at a pressure of 210 p.s.i.g. and a total temperature of 540 deg F. The turbine passes a total of 26,500 lb steam per hour at continuous maximum rating, exhausting at 40 p.s.i.g. back pressure with a total temperature of 327 deg F. The exhaust pressure is automatically controlled by a constant-pressure governor which maintains the pressure to within plus or minus 1 per cent of 40 p.s.i.g. The single-casing turbine, with four impulse stages, runs at a speed of 7,000 r.p.m. The alternator, revolving at 1,500 r.p.m., is coupled to the turbine through double helical single reduction gears. The salient pole, revolving field alternator will be equipped with a direct-coupled exciter and automatic voltage regulator. G.E.C. biased differential protection gear will also be fitted.

## Lamp Lock Orders

A list received from Checklox, 25, Melcombe Street, London, N.W.1, shows that during the past year the firm has secured orders from many parts of the world (including supplies for the Services) for its "Lox-All" lamp locks. The firm says that approximately 30 per cent of its business is with overseas concerns.

## Trade Announcements

The **Midland Dynamo Co., Ltd.,** has been appointed field service agents covering the United Kingdom for variable speed control drives for "Kalio" and "Reading" fully fashioned knitting frames, manufactured by the Reliance Electric & Engineering Co., Cleveland, Ohio, and "Oerlikon" and "Boehringer" knitting frames, made by the Schindler concern, Switzerland. The company has also been appointed field service agents for the Midlands area for the Metropolitan-Vickers Electrical Co., Ltd., whose equipments are fitted to similar imported American machinery.

New premises, including showrooms, have been opened by **C. and P. Thomas, Ltd.,** electrical wholesalers, at 54–56, Victoria Street, Bristol.

The London office of the **Kelvin-Norton Electric Co., Ltd.,** is now 3, St. Martin's Road, Stockwell, S.W.9 (telephone: Brixton 5265).

Mr. J. W. Tudor has been appointed by the Berry Hill Plant Division, **Berry Hill (Engineers), Ltd.,** Cheadle, Staffs., hydraulic engineers and colliery pumping specialists, as representative in the areas covered by the South Western and West Midlands Divisions of the National Coal Board together with the West Country, Wales and part of the East Midlands. Mr. Tudor had been with Crompton Parkinson, Ltd., for twelve years. His address is Stowford Cottage, Weston, Crewe (telephone: Crewe 2014).

After 53 years in Great Charles Street, Birmingham, 3, the **Electrical Trades Supply, Ltd.,** has moved to Albion Buildings, Vesey Street and Loveday Street, Birmingham, 4 (telephone: Aston Cross 5671/6).

## Catalogues and Lists

**Adelaide Engineering Co.,** 7, Waterloo Road, Liverpool, 22.—Leaflet on a new aluminium paint—"Alumintex"—comprising aluminium and latex.

**H. Dunning & Co. (1946), Ltd.,** Stamford Works, Stamford Road, Audenshaw, nr. Manchester.—Descriptive leaflet on the company's compression type gland for lead or aluminium cables.

**Concordia Electric Wire & Cable Co., Ltd.,** Long Eaton, nr. Nottingham.—Technical leaflet dealing with "Cordaplas" (p.v.c.) high temperature and oil resisting compounds (Pub. 953).

**Synthetic Carbon & Engineering Co., Ltd.,** Cumberland Road, Stanmore, Middlesex.—Three leaflets covering the application of metal contacts in various forms.

**H. Fisher (Oldham), Ltd.,** Pennant Street, Oldham, Lancs.—Folder containing literature on the company's range of washing machines, drying cabinets, ironers, etc.

**Siemens Electric Lamps & Supplies, Ltd.,** 38–39, Upper Thames Street, London, E.C.4.—Leaflet describing the company's recently developed earth leakage circuit breakers type P.M.45 (Z.203 3).

**Edison Swan Electric Co., Ltd.,** 155, Charing Cross Road, London, W.C.2.—Priced folder illustrating new additions to the Ediswan "Harcourt" range of commercial and decorative lighting fittings.

**Cooper Stewart Engineering Co., Ltd.,** Avenue Chambers, 4, Vernon Place, London, W.C.1.—Illustrated list of electric agricultural appliances including the "Fencemaster" electric fence unit, "Clipmaster" animal clipping machine, the "Hornmaster" de-horner for calves, etc.

**Cambridge Instrument Co., Ltd.,** 13, Grosvenor Place, London, S.W.1.—Leaflet describing the new "Cambridge" corrosion voltmeter (314).

# Light Welded Masts

## Results of Recent Field Tests

FOR a number of years British Insulated Callender's Construction Co., Ltd., has been supplying light welded radio masts up to 120ft high and assembled from standard 10ft sections bolted together. They are designed to withstand a wind velocity of 100 m.p.h. and a head load of 1,000 lb at the maximum height, but tests have shown that even under these conditions the structures have a large reserve of strength. With comparatively small masts of this class it is almost impossible to control the stay tensions during erection in accordance with the design requirements, and consequently the design has to take into account the possibility of maladjustment. It therefore follows that the true measurement of the strength of this class of mast can only be ascertained by tests.

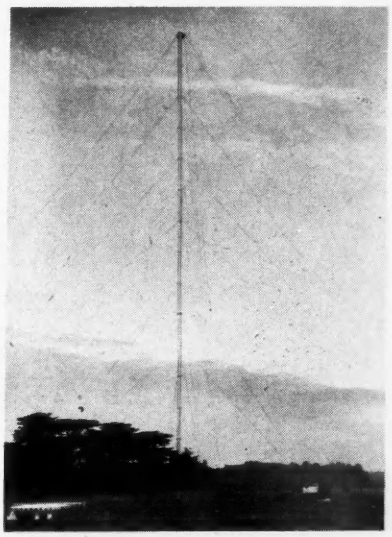
Numerous inquiries have been received as to the possibility of extending the height of these light masts, including a particularly urgent one from the Decca Navigator Co., Ltd., who wanted 150ft lightweight masts for survey work in the Sahara Desert, and in this connection B.I.C.C. decided to carry out field trials on the masts, in conjunction with Decca, at a site at Taplow Court, Buckinghamshire, the headquarters of British Telecommunications Research, Ltd., where two 150ft masts were erected and subjected to torsion, wind loading and electrical tests.

It is believed that this was the first time that a stayed structure of this height has ever been subjected to field tests, and the results have shown that even at a height of 150ft the masts are structurally sound and still have a large reserve of strength.

### Details of Mast Construction

The masts are triangular in cross section made up of standard 10ft long sections, and have built-in climbing rungs, guy attachment plates and jointing studs. The leg members with one-foot centres are of $1\frac{1}{16}$in o.d. by 11 s.w.g. class "B" tubing braced by split panel construction formed of $\frac{3}{8}$in diameter mild steel rods. The $4\frac{1}{2}$in long climbing rungs are incorporated on one face of each section at intervals of 1ft, and the bracings and rungs are fixed in position by arc welding. All the sections are hot-dip galvanized after fabrication. The masts, which weigh less than 7 lb per foot of length, are first stayed at the 30ft level and thereafter at intervals of 20ft, but guy attachment plates are provided at the top end of each section to obviate any mistakes in assembly.

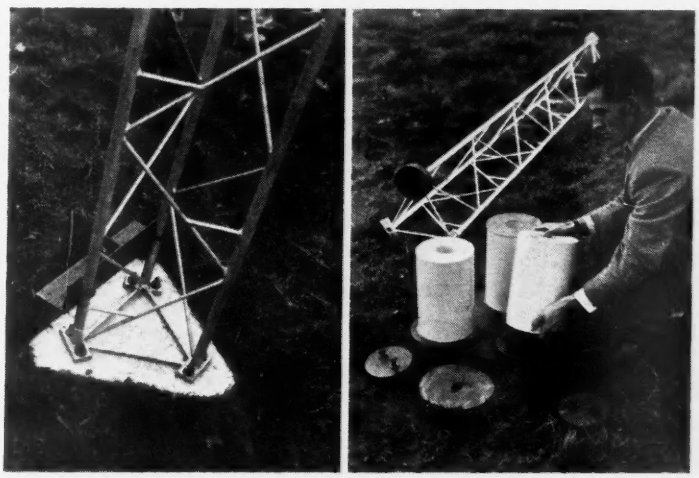
One of the masts was erected on a dished base plate which had an area of 240 sq in and took the total down-thrust of the mast and stays, amounting to approximately $4\frac{1}{2}$ tons. The more usual figure is between 3 and $3\frac{1}{2}$ tons, but here the increase was due to the various tests that were carried out.



*General view of mast "A"—complete except for the positioning of the cross-arm which was used for the torsion tests*

For use in the Sahara Desert, where there are varying types of ground, special foundations and anchorages have been designed for conditions ranging from solid rock to sand. There are two methods of erection, one employing a falling derrick and the other a 20ft long light alloy pole. The latter, which was used at Taplow, allows erection to proceed section by section in the vertical. Both of these methods require a team of six men and enable a mast of 150ft to be erected in approximately 8 hours. It is interesting to note that the two test masts were actually erected by unskilled labour under the supervision of a B.I.C.C. engineer.

The two Taplow masts were spaced 125ft apart and stayed at seven levels. Mast "B," which was later used by the Decca Navigator Co., Ltd., for electrical tests on their aerial array, had three post insulators, one per leg of the mast, inserted between the bottom standard 10ft section and the base plate. Lead packers were placed above and beneath these insulators. The stays on this structure were standard, i.e., three stays to each stay level, and all were of 7/14 s.w.g. steel wire rope of 45 tons/sq in strength, with the exception of the head "back" stay which was of 7/19 construction and 110/120 tons/sq in strength. For the electrical tests, glass rod insulators were inserted in all the stays. Mast "A," which was subjected



*One of the masts was erected on a dished base plate which had an area of 240 sq in and took the total down-thrust of the mast and stays, amounting to approximately $4\frac{1}{2}$ tons. Mast "B" (right-hand photograph) had three post insulators, one per leg of the mast, inserted between the bottom standard 10ft section and the base plate*

to torsional tests, was similarly stayed up to the 130ft level, but the head stays were varied in number and size for the three mechanical tests.

For the two torsion tests on mast "A" a horizontal member was bolted to the head of the mast so that it projected approximately 3ft on either side. A horizontal load was applied at right angles to one end of this cross arm to permit the application of a torque to the structure, and the deflection was measured against applied load.

**Table 1—Torsion Test Results with Twin Head Stays**

| Torque lb-ft | Rotation degrees | Torque lb-ft | Rotation degrees |
|---|---|---|---|
| 450 | 3 | 1,200 | 7 |
| 600 | 4 | 1,350 | 7 |
| 750 | 5 | 1,500 | 7 |
| 900 | 6 | 1,650 | 8 |
| 1,050 | 6·8 | 1,800 | 8 |

**Table 2—Torsion Test Results with Single Head Stays**

| Torque lb-ft | Rotation degrees | Torque lb-ft | Rotation degrees |
|---|---|---|---|
| 150 | 9 | 450 | 10·5 |
| 300 | 10 | | |

The whole of the test was repeated with single stays only.

To restrict angular movement under torsional load two head stays were used in each of the three directions, with a small couple arm between them. The torsion test results are given in Tables 1 and 2.

A test to reproduce the condition of wind force by a system of loading between the two masts was carried out by attaching ropes at various levels to mast "A," taking them over pulleys at corresponding levels on mast "B" and applying weights.

A load of 1,700 lb was applied to the masts at the 150ft level, and measurements taken of the deflection at the mast heads. The test results, Table 3, showed that the masts could easily take a 2,000 lb head load without being crippled.

**Table 3—Test Results**

| Head Load lb | Deflection in |
|---|---|
| 1,000 | 7·2 |
| 1,200 | 8·6 |
| 1,400 | 10·0 |
| 1,600 | 11·5 |

# CANADIAN DEVELOPMENT

LAST year the completion of 638,000 h.p. of hydro-electric generating plant brought the total hydraulic capacity in Canada to 14,921,000 h.p. In addition a number of steam sets and diesels in remote districts were commissioned. During the coming and immediately subsequent years 1,500,000 h.p. is expected to be brought into service. A survey by the Water Resources Division covers ten provinces in which 48 plants are in operation; these are made up of six public boards, seven municipalities, twenty-six power companies and nine large industrial concerns.

Brief particulars are given of plant installed in 1953 and under construction or planned in each area with notes on new transmission lines and on rural development. Reference is made to other large projects under investigation such as the harnessing of the international rapids of St. Lawrence River. While many of the more convenient sites have already been developed, these represent less than 23 per cent of the total water power resources of Canada; technical advances in long distance transmission tend to make further sites available for connection to existing generating systems.

Electricity consumption in 1953 was 7 per cent greater than in 1952, but there was little reserve capacity. Some relief from the effect of peak loads was achieved by interconnection between independent systems.

One of the most notable schemes in hand is that of the Aluminum Co. of Canada at Kitimat in British Columbia. This entails the diversion of the headwaters of Fraser River through the Coastal Range by means of ten miles of 25ft diameter tunnel from Tahtsa Lake, which together with the underground power station and a 50 mile transmission line from Kemano have now been completed. Three 106 MVA generators driven by 140,000 h.p. turbines are expected to be in operation in May. The ultimate capacity is given as over 2 million h.p.

The largest power station of the Ontario Hydro-Electric Power Commission is the Sir Adam Beck No. 2 station of 1,260,000 h.p. on the Niagara River at Queenston, where the first of twelve 105,000 h.p. sets is nearly ready for service. The original scheme was amended last year to provide for later pumped storage. Associated with a new reservoir of 15,000 acre-feet are four pump-turbines driving generators with a total capacity of 170,000 kW for use when water is being discharged from the reservoir.

The capacity of the Commission's Richard L. Hearn steam station, Toronto, will be 400 MW when the frequency of the remaining 25 c/s unit has been changed to 60 c/s. At the J. Clark Keith station, Windsor, the installation of two more 66 MW units in 1953 brought the capacity up to 264 MW. Additions to the Commission's transmission system, including interconnection with the Detroit Edison Co., comprised 42 circuit miles of 230 kV lines and 204 circuit miles of 115 kV lines; the number of farm services is about 133,000.

The Quebec Hydro-Electric System brought its Beauharnois No. 2 power station up to its planned capacity of 660,000 h.p. by the addition of one 55,000 and one 50,000 h.p. units, making the overall St. Lawrence River capacity 1,408,000 h.p. The installation is expected ultimately to reach 2 million h.p. Construction of a 300,000 h.p. station was begun 60 miles above the mouth of Bersimis River, which flows into the St. Lawrence River 200 miles downstream from Quebec; the estimated capacity of this site is 1,200,000 h.p. The Aluminum Co. of Canada finished the last 57,000 h.p. unit in its 285,000 h.p. station on the Peribonka River. About 150,000 h.p. in the aggregate is to be installed by the Shawinigan Water & Power Co. in three existing stations for commissioning late in 1955. In the same province, the Manicouagan Power Co. brought into use a second 56,200 h.p. set; four similar units are to be added as required. This plant will be connected to the transmission system of the Quebec H.E. Commission this year.

### *Charges for Off-Peak Supplies*

A SUGGESTION that there should be some concession in charges for bulk supplies taken during off-peak hours was recently passed on to the South East Scotland Electricity Board by the Consultative Council. The Board, in its reply, read at the last meeting of the Council, said that this point had been discussed with the Central Authority which had indicated its willingness to consider a reduced night charge and an increased day charge. The majority of the Area Boards were against this and the proposal was abandoned.

Mr. J. M. Airlie, chairman of the Consultative Council, pointed out that during off-peak hours only enough plant was operated to meet the load required. Extra output would mean that additional generators would have to be used. He thought there was a danger of peak-period consumers having to subsidize off-peak users.

### *Cooker Wiring Decision*

Warwick Council is to include in future contracts for the erection of houses the necessary wiring to enable tenants to install electric cookers if they wish.

### *Steam Station Output*

The weekly statistical statement issued by the Ministry of Fuel and Power shows that during the 52 weeks ended 1st January, 1954, a total of 60,033 million kWh was sent out for public supply from solid-fuel fired generating stations. This compares with 56,583 million in the corresponding period ended 2nd January, 1953, an increase of 3,450 million kWh (6 per cent). In the accompanying graph of weekly output figures and average weekly temperatures the effect of the milder weather in the last two weeks of November and first three of December will be apparent. Partly as a result of this the distributed stocks of coal at power stations totalled 6,067,000 tons at 26th December (equal to 6·9 weeks' supply) compared with 5,298,000 tons (6·5 weeks' supply) at 27th December, 1952.

### *Policy on Overhead Lines*

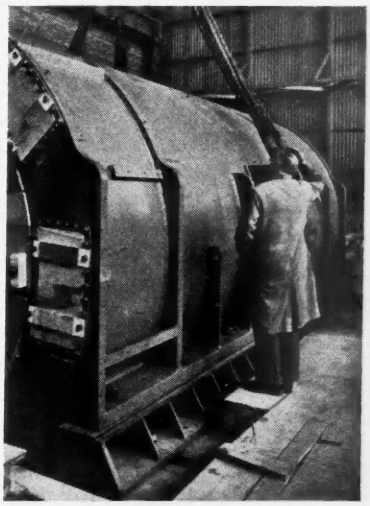
Estate developers at Sidmouth are to be asked to attend a conference with members of the Town Planning Committee and representatives of the public utilities before embarking on any future schemes. An attempt will then be made to come to an arrangement whereby the electric cables can be placed underground and the laying of the various services co-ordinated. At a recent meeting of the Committee, Brig. R. D. Whitehill said that parts of Sidmouth had been completely spoilt by the festooning of overhead wires.

### *Water for Croydon "B"*

Objections have been lodged by the Carshalton, Beddington and Wallington, and Mitcham Councils to an application by the British Electricity Authority for a licence to construct works and abstract underground water, up to a maximum of 500,000 gal a day, for the Croydon "B" generating station. It is thought that the proposal, by diminishing the flow of springs and watercourses, might result in the stagnation of Carshalton Ponds and the upper reaches of the River Wandle.

### *Stator for Carrington*

The stator of the second of four Metropolitan-Vickers hydrogen-cooled 75,000 kVA turbo-generators for the Carrington power station of the North Western Division of the British Electricity Authority was dispatched from the company's Trafford Park Works on New Year's Day and is here seen being lowered into position in the power station.



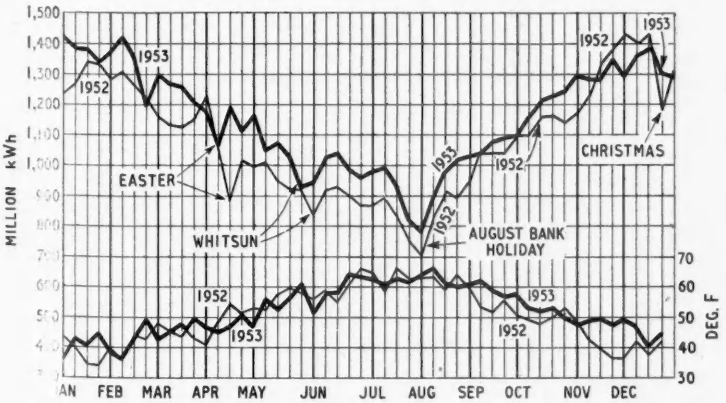
*A Metropolitan-Vickers stator being lowered into position at Carrington power station*

### *Yorkshire Rural Supplies*

The link up of the villages of East Marton and West Marton, near Skipton, with the supply network is the latest contribution of the Yorkshire Electricity Board to the extension of electricity supplies to the Craven rural areas. Work is also proceeding on taking a supply to Elslack and Banknewton, and it is expected that later in the year electricity will be made available at Coniston Cold and Bell Busk. In the following year Hawkswick and Arncliffe in Littondale, together with Buckden, at the head of Wharfedale, are scheduled to get electricity.

### *Objections to Power Station Plan*

The proposal of the British Electricity Authority to build a new power station at The Leys, Gileston, is to be discussed at a meeting of representatives of the Glamorgan County Council and other interested bodies at Cardiff on Monday next. In a report on the subject by Mr. S. P. Youldon, planning officer to the Cardiff Rural District Council, objections are raised to the scheme on the grounds of its effect upon agriculture, housing, transport and amenities. He says it is clear that "the erection of a building of this type




*Weekly electricity output (solid-fuel fired stations only) and average weekly temperature curves*

and inhuman scale in such an area will completely destroy the amenities and cannot be regarded as anything but an eyesore." Some 50–60 acres of first-class agricultural land will have to be taken for sidings, apart from which there will be a serious drain on local manpower employed in agriculture. There will be a further demand for houses to be built by the local authorities and a consequent heavy rate burden amounting to £8 18s per house each year; additional public services will increase the cost to local ratepayers. Another factor is that the highway from St. Athan to Rhoose and Barry is extremely dangerous and incapable of carrying further heavy traffic. The opinion is expressed that any such building should be sited in an industrial area close to a centre of population.

### *Supply to Kent Village*

Romney Marsh R.D.C. has been informed that the work of supplying electricity to Ivychurch may begin this year. Though the tenants have had to cook by oil stoves or container gas, all post-war houses in the village have been electrically wired.

### *Tenants to Buy Own Cookers*

Because of trouble over the gas and electric cookers installed by the Cookham (Berks) Council, particularly with regard to size, the Council has decided that in future tenants will have to provide their own equipment of this kind. In view of the hire-purchase facilities available it is not thought that there will be any financial hardship.

### *Power Station Lighting*

Fluorescent lighting has recently been installed in an extension to the main engine room at St. Sampson's generating station, Guernsey, which already houses two of the three projected 1,000 kW sets. Eighteen "Mazda" 5ft fluorescent angle reflector fittings are used beneath each crane rail, and a central row of nine fluorescent reflectors with upward light slots are mounted at roof truss level.

### *More Power for Midland Farms*

In the current financial year the Midlands Electricity Board expects to spend nearly £750,000 on rural electrification and connect about 1,000 farms. A review of progress just completed shows that in the first six months of the financial year, up to 30th September last, 436 farms were connected, bringing the total served at that date to 14,163, compared with just under 8,000 when the Board was established. It is hoped by an all-out effort to achieve a 10 per cent improvement on the previous best yearly total by connecting 1,000 farms, apart from many other rural premises, before the current year ends on 31st March.

### *School Installations*

Southampton Corporation is to make application for sanction to borrow the sum of £19,832 to cover the cost of the renewal and improvement of the electrical installations at various schools.

### *Kitimat Tunnel Completed*

Boring of the 10-mile tunnel through a mountain in connection with the Kitimat project of the Aluminum Company of Canada has been completed. The tunnel is 25ft in diameter and was built in two sections with crews working through Mount DuBose from each side of the mountain. The join was true to an inch. Men working on the project are claimed to have broken all world records for a job of this size and nature. The tunnel will carry the water westward through the granite mountain from the reservoir created by the Kenney dam. From the tunnel the water will continue through penstocks half a mile down to the turbines of a power house built a quarter of a mile inside the mountain itself. The power will be transmitted 50 miles across a mountain range to Kitimat where the smelter of the Aluminum Company is under construction and will commence production next year. Lining of the tunnel and installation of concrete flooring for the entire length has still to be completed.

### *Installations in Pre-War Houses*

Seaton Valley U.D.C. has authorized the surveyor to prepare a scheme for the installation of electricity in pre-war council houses at Seghill.

Kingsclere and Whitchurch (Hants) R.D.C. reports that the Ministry of Housing and Local Government has approved a scheme for the installation of electricity in 101 pre-war council houses.

Hebburn-on-Tyne General Purposes Committee has invited the North Eastern Electricity Board to discuss with the Council the supply of electricity to houses in the Spencer Street area at present served only by gas. The Board had previously stated that the work could not be started immediately as the existing network could not carry the extra load and a new substation would have to be erected.

### *Substation Sites*

Scunthorpe Corporation is recommended to approve plans for the proposed erection of substations at Spencer Avenue, Scotter Road, St. Margaret's Walk and Healey Road.

Bournemouth Housing and Estates Committee has approved the allocation of a site on the West Howe estate to the Southern Electricity Board for the erection of a transformer substation.

Edmonton Borough Council is to raise no objection to plans submitted by the north area planning officer for the erection of substations at the following sites: Ridge Avenue, N.21; Little Bury Street, N.9; Bury Street/Gaillard Road, N.9; and St. Edmund's Road, N.9.

Luton Housing and Estates Committee proposes to lease two sites, with frontages to Waterslade Green and Leyburne Road to the Eastern Electricity Board as sites for substations.

Sheffield Estates Committee is to lease to the Yorkshire Electricity Board a site on the Greenhill-Bradway estate for the proposed erection of a substation.

### *Rewiring of Town Hall*

Bournemouth General Purposes and Parliamentary Committee has instructed the borough engineer to complete the renewal of the electrical wiring in the Town Hall by stages, the next section being the lower ground floor.

*In the new extension to the main engine room at St. Sampson's generating station, Guernsey, lighting is by "Mazda" fluorescent reflector fittings*

# LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

### Legislation and Metering Costs

REFERRING to "Cathay's" letter in your issue of 25th December, the price of a single-phase meter is given as £3 2s 6d with depreciation over thirty years. Interest (5 per cent) and depreciation are shown as an annual charge of 5s 3d. This means that the total charge on a meter is 5s 3d multiplied by 30, which equals £7 10s 6d. The cost of financing the purchase of a meter is therefore the difference between £7 10s 6d and £3 2s 6d, which is £4 8s. "Cathay" estimates the cost of testing, fixing, changing and repairing a meter over the period of thirty years at £3 2s 6d.

The cost of financing the purchase of a meter with interest at 5 per cent is thus far more than either the original cost of the meter or its testing and maintenance over thirty years. We ought to demand legislation to reduce the interest charges on loans required by our industry.

*Welwyn Garden City.* B. CROWSLEY, A.M.I.E.E.

### Loss of Units

WITH reference to the suggestions made by "Nomad" in your issue of 25th December, I agree it is a deplorable fact that a large proportion of the staff employed in the supply industry do not use an electric cooker or a water heating appliance.

I do not agree, however, that it is good policy to introduce a "staff tariff." Surely we in the industry do not require special concessions to enable us to use an appliance which, as we advocate, can hold its own against any competition, whether it be gas, solid fuel or oil.

After 30 years' experience of cooking and heating water by electricity, I can, without any hesitation, recommend the non-electrical enthusiasts in the supply industry to make 1954 a year to show loyalty to the industry from which they derive a livelihood by installing a cooker and/or a water heater and advocating their virtues to those with whom they have contact.

A.J.M.

MR. PHILIP HONEY, in your issue of 27th November, deplores the loss of between 30 and 40 million kWh of sales for traction purposes and "Nomad" suggests in your issue of 25th December that if those employed by the B.E.A. would install electric cookers at least a further 40 million kWh would be sold. It is a good sign that some of us are looking for the means of increasing the sales of electricity.

It is doubtful whether "Nomad" has correctly estimated the number of employees' houses without electric cookers. There are many single men and women employed in the industry and there are many cases where both man and wife work for the B.E.A. My view is that a staff tariff would not improve matters. It is other factors, such as the expense of wiring cooker points in houses that they do not own, which prevents many employees from installing a cooker.

Far greater sales could be made to domestic consumers if the Boards would hire modern apparatus. I feel confident that a further 10 per cent of houses would use electricity for cooking if modern cookers could be hired, and as there are 10 million homes the addition of 1,000 kWh in one million of them would increase the total sales by 1,000 million kWh annually. Hired water heaters would account for millions more. Why do the Boards restrict hiring? Is it because the sale of apparatus is favoured more than the sale of units?

"NAMDAM."

### Installation Plans

WITH regard to the first paragraph of "Views on the News" in your issue of 25th December, it may be of interest that in Copenhagen it is not possible to get an electrical installation passed and connected to the supply without the provision of duplicate copies of plans showing all floors separately and to scale.

I recall preparing such plans more than forty years ago. They were done on tracing cloth, indicating all windows, doors and stairs and showing all fittings by symbols very similar to our standards here. Walls were filled in in red ink on the back, all wiring in blue lines, lighting points in red and switches, motors and plugs in black. All installations were tested for insulation and earth faults and all switches and starters were tested with the current on before approval by an inspector and before the meter was installed.

The contractors were responsible for all the above work and were willing to prepare plans for clients if desired.

*Manchester*, 10. N. SKOVGAARD.

## Aircraft Communication

IN a paper presented on Wednesday before the Institution of Electrical Engineers' Radio Section, Mr. G. W. Barnes (Royal Aircraft Establishment) discussed the advantages of applying a single-sideband controlled-carrier system of telephony (instead of a manual telegraph system) to aircraft communication at high frequencies. After describing methods of overcoming the difficulties encountered and the design of components, the author concluded, as a result of test flights up to 800 miles, that the technique adopted was entirely feasible. To provide automatic tuning for pilot operation the crystal-oscillator frequency tolerance should be improved to restrict carrier frequency error to within 300 c/s. The ultimate aim, he said, should be the reduction of the possible carrier error to a value which permitted the operation of a single-sideband system without carrier frequency control, as this would simplify receiving equipment and provide greater immunity from interference.

The author's experience showed that the peak side-band power of the transmitter should be 300 W for ranges up to 1,000 miles and that the single-sideband system should be used in both directions. It was admitted that the performance of a manual telegraph could not be equalled, although this could be improved by reducing the band width to that strictly necessary for transmitting a coded signal.

# Planned Lighting

LIGHTING installations are now generally planned, either to conform to the architectural features of the building, or, as in the case of industrial installations, to provide adequate illumination for the particular job being done in the workshop. On the opposite page we illustrate some examples of recent installations.

The McEwan Hall, Edinburgh University, has recently been restored to its original condition, redecorated, and equipped with new ventilation, heating and lighting. Of particular note is the skilful use of cold cathode fluorescent lighting by means of which the richly decorated ceilings have been made fully visible probably for the first time. This installation, by George Forrest & Son, Ltd., consists of a cornice carrying four runs of cold cathode lamps of varying size. The hall is 100ft in width and approximately 100ft high overall and the lighting fittings are mounted at 60ft. The total lighted length of lamp run is 1,200ft. The upper gallery is illuminated by fourteen trough reflectors each containing three 75 W incandescent lamps mounted on the capitals of the columns. The lower gallery has fourteen indirect reflectors each containing three 75 W tungsten lamps mounted with curved backplates on the column radius.

At the reconstructed shop premises of Boots Pure Drug Co., Ltd., at Plymouth, Mr. C. St. Clair Oakes, chief architect to Boots, planned a lighting scheme in collaboration with the General Electric Co., Ltd. In the ground floor sales area high level illumination of the order of 30 lumens per sq ft is obtained from thirty special 2ft 6in diameter amber tinted " Perspex " bowl fittings, mounted on the ceiling and each equipped with four 150 W " Osram " lamps. High intensity counter lighting is provided by eighty-four " Gecoray " reflectors equipped with 150 W lamps recessed into the ceiling. Behind the service counters diffused lighting is afforded by cold cathode tubing concealed behind an egg crate louvre ceiling. Some 400ft of tubing is employed; it is in three rows, the centre in gold and the outer rows in " warm white."

For the first floor sales area there are twenty-one fittings. Each is in the form of a truncated cone in sheet steel finished aluminium colour. The windows of the store are lighted by a combination of tubes and tungsten lamps supplemented by concealed fluorescent tubes at the sides and bottom. Mr. F. Walker, chief electrical engineer, Architects' Department of Boots, was responsible for all the electrical layout, and the installation work was carried out by the Devon Electric Supplies Co., Ltd.

## Australian Installation

The Illuminating Engineering Society recently made an award to Telephone & Electrical Industries, Pty., Ltd., for the most meritorious lighting installation in Australia. Installed by the company's own Engineering Department, in co-operation with the Australian representatives of Siemens Electric Lamps & Supplies, Ltd., and Benjamin Electric, Ltd., the overhead general lighting system incorporates 1,200 240 V filament lamps, supplemented where necessary with 500, 32 V local lights and fluorescent fittings. The sub-assembly department is illuminated by Siemens filament lamps for general lighting, and fluorescent tubes fitted with Benjamin continuous-trough reflectors for task illumination. The general level of the overhead illumination for this department is 14 ft-candles, with 50 ft-candles on the bench.

The new building (St. Bridget's House, London) occupied by Unilever, Ltd., and associated companies has been equipped throughout with " Ekco " fluorescent lighting fittings. The electrical installation was planned by the Technical Division, Engineering Department of Unilever, Ltd., and the high standard of glare free lighting has been obtained with fittings designed in a matching range covering 5ft, 4ft, 3ft and 2ft units, so that a pleasing uniformity has been obtained in private offices, general offices, corridors and landings.

A good example of showroom lighting is that of Powers Samas Accounting Machines, Ltd., High Holborn, London, W.C.1. This installation employs the lighting units of Courtney, Pope (Electrical), Ltd. General lighting is provided by means of two-length recessed fluorescent lighting fittings with glass diffusing panels utilizing in each section two 5ft fluorescent lamps. Emphasis lighting is provided by means of a specially modified " Conaliter " fitting which can be plugged into special socket outlets provided on the ceiling. The electrical contractors were Bell Bros. & Co. (London), Ltd.

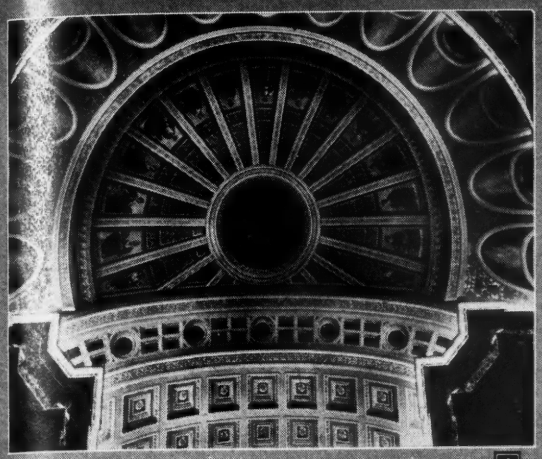
## Railway Shed Illumination

An important part of the British Railways organization is the cleaning of coaches after a journey so that they shall return to service in first class condition as quickly as possible. In the case of London Midland Region main line coaches and sleeping cars, this work is done at the new 370 yd long Willesden shed where some 430 " Metrovick " fluorescent fittings have been used. The lighting installation was planned by the Railways' engineers and the lighting fittings were designed and built to the special requirements of British Railways. They consist of a heavy gauge channel containing the lamp operating gear which is fixed on a backplate. All metal parts are heavily cadmium plated apart from the sheet steel which is vitreous enamelled white. Two main types of fittings have been used. The first type are two-lamp channel fittings, for 5ft 80 W daylight lamps, with angle reflectors. These are mounted on the walls at the eaves 18ft above ground level, 20ft apart. The second type are simple channel fittings for either one or two 5ft 80 W daylight lamps which are mounted 13ft above ground level below the walkways.

An interesting industrial installation has been completed in the machine shop of Lake & Elliott, Ltd., iron-founders, Braintree, Essex. The installation was planned by lighting engineers of the British Thomson-Houston Co., Ltd. It consists of 106 " Mazda " industrial twin-lamp fluorescent reflector fittings, with upward lighting slots, mounted between roof trusses 16ft above the floor. There are seven rows of twelve fittings and two rows of eleven, spaced 12½ft between fittings and 13ft between rows. The illumination on the working plane is approximately 16 lumens per sq ft. The installation and wiring were carried out by the company's own electrical staff under the direction of Mr. H. Scott, works engineer.

*(1) The ceiling of the McEwan Hall (George Forrest & Son, Ltd.). (2) Combined tungsten and fluorescent lighting at the works of Telephone & Electrical Industries, Pty., Ltd., Australia (Siemens Electric Lamps & Supplies, Ltd., and the Benjamin Electric, Ltd.). (3) Powers Samas Accounting Machines, Ltd., showroom (Courtney, Pope (Electrical), Ltd.). (4) Willesden Shed, British Railways (Metropolitan-Vickers Electrical Co., Ltd.). (5) Boot's premises at Plymouth (General Electric Co., Ltd.). (6) Unilever Offices, St. Bridget's House, London (Ekco-Ensign, Ltd.). (7) Machine shop, Lake & Elliott, Ltd., Braintree (British Thomson-Houston Co., Ltd.)*

# Examples of Modern Lighting



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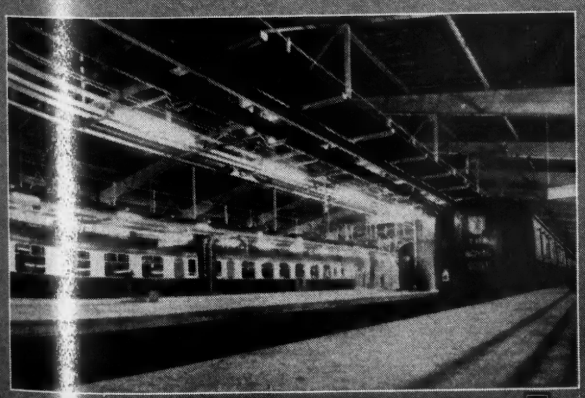

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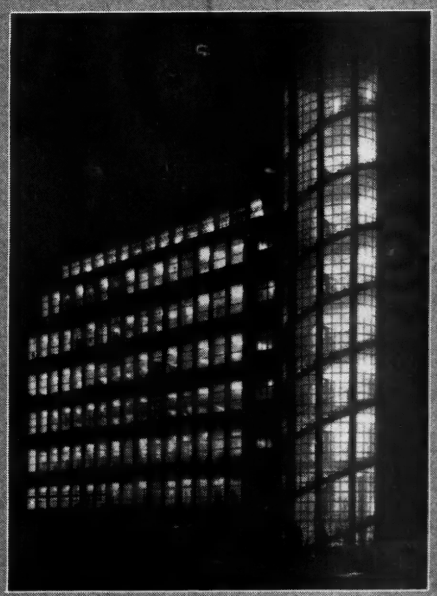

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## *Financial Section*

# STOCKS and SHARES

STOCK EXCHANGE markets continue to resist the disturbing influence of developments in connection with the electrical and engineering wages problems. Gilt-edged stocks were marked down by a fraction here and there, but industrials as a whole did rather better than hold their ground: indeed, the indices of leading industrial share prices at one time broke through the peak established in 1953. The main support for this market, it is generally agreed, rests on expectations of good company results for the past year. News of this kind should start flowing within a few weeks and gather volume during the two or three following months. This promises to be a season of unusual interest.

### Price Changes

Plessey 5s shares, one of the outstanding market performers in recent months, reached new heights in rising to 40s. Useful advances were recorded by, among others, Crabtrees, Greenwood & Batley, Desoutter, Dubilier and Burco. In the engineering group, Babcocks and Metal Industries again improved, and there were rises in Thornycroft and International Combustion. Deccas and Ericssons lost 1s 3d of their previous advances. Mention may be made of discrepancies in one or two instances between market prices and the official quotations on which the accompanying tables are based. In particular, Brook Motors have been changing hands at over 34s against the official price of 31s 6d; Morphy Richards are nearer 18s 6d than the list price of 16s 6d.

### End of E.P.L.

Scarcely a voice has been heard in any quarter to lament the passing, at the end of 1953, of the excess profits levy. Introduced in Mr. Butler's first Budget, it has cost industry £100 million or more annually and seems to have discriminated against nothing but successful and progressive enterprise. Its depredations will of course still be apparent in the majority of the company results yet to be published in respect of the past year. Thereafter, however, its disappearance will mean for many firms a really substantial lightening of the tax load, and few industries will feel the benefit more than the electrical trades. It seems safe to assume that any new imposition to take its place would be designed carefully to avoid the " disincentive " effect of the old one.

Excess profits levy cost the A.E.I. group over a million in their 1952 accounts, and will presumably have exacted a similarly heavy toll in the twelve months just ended. Companies which paid half a million or more last time under the same heading included English Electric, Babcock & Wilcox and Lucas; B.I.C.C. contributed almost as much. Among many others whose accounts have shown a large liability to the levy, either absolutely or in relation to the scale of earnings, are Reyrolle and Parsons (the figure in

## *Week's Price Changes*

| Company or Board | Nom. Value | Middle price 11th Jan. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % | 1953 Highest | 1953 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Gilt-edged Stocks* | | | | | | £ s d | | |
| Brit. Elec. 1968/73 ... ... | 100 | 89⅛ | | 3 | 3 | 3 7 0 | 90 | 83 18 |
| Brit. Elec. 1974/77 ... ... | 100 | 88½ | | 3 | 3 | 3 7 9 | 89 | 82 |
| Brit. Elec. 1976/79 ... ... | 100 | 94 | | 3½ | 3½ | 3 14 6 | 94⅞ | 88⅛ |
| Brit. Elec. 1974/79 ... ... | 100 | 104½ | +½ | 4¼ | 4¼ | 4 1 3 | 104 | 99¼ |
| *Overseas Electric Supply* | | | | | | | | |
| Calcutta Elec. ... ... ... | £1 | 19/6 | | 6† | 6† | 6 3 0† | 21/- | 18/- |
| East African Power ... ... | 20/- | 22/- | | 7 | 7 | 6 7 3 | 25/- | 20/9 |
| Nigerian Elec. ... ... ... | £1 | 24/6 | | 10 | 10 | 8 3 4 | 25/- | 21/6 |
| Palestine Elec. " A " ... ... | £1 | 16/6 | | Nil | Nil | Nil | 19/3 | 7/7 |
| Perak Hydro-Elec. ... ... | £1 | 13/6 | | Nil | 6 | 8 17 9 | 17/10 | 13/6 |
| *Equipment and Manufacturing* | | | | | | | | |
| Aberdare Cables ... ... ... | 5/- | 8/6 | +3d | 20 | 25 | 7 7 1* | 8/9 | 7/4 |
| Aerialite ... ... ... ... | 1/- | 11/6 | | 88⅛ | 88⅛ | 7 13 9 | 11/6 | 8/1 |
| Allen, W. H. ... ... ... | £1 | 50/- | | 15 | 15 | 6 0 0 | 51/- | 42/10 |
| Aron Elec. Ord. ... ... ... | £1 | 43/9 | | 15 | 20 | 9 2 9 | 47/6 | 36/3 |
| Assoc. Elec. Ord. ... ... ... | £1 | 42/6 | | 20 | 20 | 4 14 3* | 45/7 | 36/4 |
| Automatic Tel. & El. ... ... | £1 | 63/9 | | 15 | 15 | 4 14 0 | 65/3 | 55/- |
| Babcock & Wilcox ... ... | £1 | 50/- | +1/9 | 18 | 18 | — | 50/- | 40/4 |
| Baldwin, H. J. ... ... ... | 2/- | 4/3 | | 20 | 20 | 9 8 0 | 4/1 | 3/- |
| Bakelite ... ... ... ... | 10/- | 23/6 | | — | 12½ | 5 6 6 | 24/9 | 16/- |
| British Aluminium ... ... | £1 | 37/- | | 12 | 12 | 6 9 8 | 43/10 | 35/- |
| B.I. Callender's ... ... ... | £1 | 38/3 | | 9 | 10 | 5 4 6 | 40/10 | 33/3 |
| B.I. Callender's 6% Pref. ... | £1 | 25/- | | 6 | 6 | 4 16 0 | 26/3 | 23/- |
| British Thermostat ... ... | 5/- | 17/6 | −1/3 | 30 | 35 | — | 19/- | 14/- |
| British Vac. Cleaner ... ... | 5/- | 12/- | +9d | 25 | 25 | 10 17 6 | 16/6 | 11/- |
| Brook Motors ... ... ... | 10/- | 31/6 | −1/- | 20 | 20* | 6 9 0 | 37/- | 27/10 |
| Brush Ord. ... ... ... | 5/- | 4/- | | 10 | 4 | — | 5/4 | 2/11 |
| A. F. Bulgin ... ... ... | 1/- | 3/3 | | 30 | 30 | 9 4 6 | 3/5 | 2/6 |
| Burco ... ... ... ... | 5/- | 12/9 | +1/- | 35 | 35 | 6 17 3* | 12/2 | 8/6 |
| Chloride El. Storage ... ... | £1 | 48/3 | −6d | 15 | 20 | 4 3 0* | 44/10 | 32/3 |
| Clarke Chapman ... ... ... | £1 | 72/6 | +2/- | 15 | 17½ | 4 16 6 | 70/6 | 57/6 |
| Cole, E. K. ... ... ... | 5/- | 23/9 | | 25 | 25* | 5 5 3 | 23/9 | 14/2 |
| Cossor, A. C. ... ... ... | 5/- | 7/3 | | 10 | 10 | 6 18 0 | 11/4 | 6/4 |
| Crabtree ... ... ... ... | 10/- | 24/6 | +9d | 17½ | 17½ | 7 2 10 | 32/6 | 23/9 |
| Crompton Parkinson Ord. ... | 5/- | 14/3 | | 11½ | 20 | 7 0 3 | 16/- | 8/7 |
| De La Rue ... ... ... ... | 5/- | 12/6 | −6d | 35 | Nil | Nil | 14/6 | 6/3 |
| Decca ... ... ... ... | 5/- | 36/6 | −1/3 | 112½ | 150 | 4 2 3* | 37/9 | 17/6 |
| Desoutter ... ... ... ... | 5/- | 16/9 | +6d | 16 | 18 | 5 7 6 | 17/6 | 14/3 |
| Dewhurst ... ... ... ... | 2/- | 6/3 | | 19 | 19 | 6 1 6 | 6/9 | 5/- |
| Dictograph Tel. ... ... ... | 2/- | 5/6 | +3d | 20 | 20* | 7 5 6 | 5/10 | 3/10 |
| Dubilier Condenser ... ... | 1/- | 4/3 | +3d | 28 | 25* | 5 17 9 | 4/4 | 2/10 |
| E.M.I. ... ... ... ... | 10/- | 11/9 | +3d | 12 | 8 | 6 16 3 | 15/3 | 11/6 |
| Electrical Components ... ... | 5/- | 12/- | | 20 | 20 | 8 6 8 | 12/- | 9/3 |
| Elec. Construction ... ... | £1 | 53/9 | | 15 | 15 | 5 11 9 | 56/- | 50/6 |
| Enfield Cable Ord. ... ... | £1 | 18/- | +6d | 7½ | 5 | 5 11 0 | 24/10 | 17/- |
| English Electric ... ... ... | £1 | 39/9 | | 15 | 15 | — | 40/8 | 34/- |
| English Electric 3½% Pref. ... | £1 | 16/- | | 3½ | 3½ | 4 13 9 | 16/4 | 13/6 |
| Ericsson Tel. ... ... ... | 5/- | 47/6 | −1/3 | 22† | 22†* | 2 6 3† | 48/9 | 35/- |
| Ever Ready ... ... ... | 5/- | 27/3 | | 35 | 35 | 6 8 6 | 29/- | 25/- |
| Falk Stadelmann ... ... ... | £1 | 37/6 | −9d | 15 | 15 | 8 0 0 | 44/3 | 33/3 |
| G.E.C. Ord. ... ... ... | £1 | 38/9 | | 22½ | 11¼* | 5 16 3 | 46/- | 35/3 |
| G.E.C. 6¼% Pref. ... ... | £1 | 27/- | | 6½ | 6½ | 4 16 3 | 27/7 | 24/9 |
| General Cables ... ... ... | 5/- | 16/3 | | 30 | 30 | 9 4 9 | 17/- | 13/9 |
| Greenwood & Batley ... ... | £1 | 41/9 | +1/- | 15 | 17½ | 8 7 9 | 41/6 | 33/- |
| Hackbridge Cable ... ... | 5/- | 11/9 | −6d | 20 | 20 | 8 10 3 | 13/- | 10/4 |
| Hackbridge & Hewittic ... ... | 5/- | 17/6 | | 20 | 20 | 5 14 3 | 18/3 | 15/1 |
| Hall Tel. Acc. ... ... ... | 10/- | 11/- | | 10 | 10 | 9 1 9 | 12/7 | 8/6 |
| Heatrae ... ... ... ... | 2/- | 3/9 | −3d | 12½ | 12½ | 6 13 4 | 4/3 | 3/3 |
| Henley's ... ... ... ... | 10/- | 16/3 | +3d | 20 | 10½* | 6 9 3 | 19/4 | 15/- |
| Holophane ... ... ... | 5/- | 13/9 | | 20 | 20 | 7 5 6 | 13/9 | 11/1 |

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

both cases being over £300,000), International Combustion (£190,000), S. Smith (£160,000), Scottish Cables (£[illegible],000), Telegraph Condenser (£[illegible],000), Ward & Goldstone (£[illegible],000), R. B. Pullin (£10,000), Radio Rentals (£104,000) and Westinghouse Brake (£103,000).

### Reyrolle Earnings

A. Reyrolle £1 shares, which rose a further 1s 3d last week to 67s 6d, remain much in favour. A new market calculation of the company's earnings in relation to the recently increased ordinary capital does something to explain their popularity. Last year, the company paid dividends totalling 12½ per cent out of surplus profits equivalent to 80 per cent on the ordinary capital then ranking. That rate of earnings is calculated as equal to just short of 50 per cent on the present capital, which has since been increased by the "rights" issue of a million new shares at 40s. It is further computed, incidentally, that the rate would have been some 24 per cent higher in the absence of E.P.L., and much higher again if Reyrolle's portion of the undistributed profits of C. A. Parsons were to be included. (Reyrolle is stated to hold 40 per cent of that company's ordinary shares.) The conclusion is reached that stockholders can count on a total of not less than 15 per cent for 1953. The official announcement is due to be published in April.

## ...in Electrical Investments

| Company or Board | Nom. Value | Middle price 11th Jan. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % £ s d | 1953 Highest | 1953 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Equipment and Manufacturing—continued.* | | | | | | | | |
| Hoover | 5/- | 26/9 | −3d | 35 | 25 | 4 13 6 | 26/10 | 20/3 |
| I.C.I. | £1 | 53/6 | −6d | 13 | 13 | 4 17 3 | 54/- | 41/6 |
| Intl. Combustion | 5/- | 15/6 | +6d | 25 | 15* | 4 16 9 | 15/6 | 12/1 |
| Johnson & Phillips | £1 | 50/- | | 15 | 15 | 6 0 0 | 59/3 | 49/- |
| Lancashire Dynamo | £1 | 43/9 | | 12½ | 12½ | 5 14 3 | 47/- | 41/- |
| Laurence, Scott | 5/- | 13/9 | | 15 | 15 | 5 9 0 | 14/6 | 11/9 |
| Lister, R. A. | £1 | 31/6 | −6d | 9 | 9 | 5 14 3 | 34/3 | 27/9 |
| London Elec. Wire | £1 | 38/6 | | 12½ | 15 | 3 18 0 | 38/3 | 26/- |
| J. Lucas | £1 | 51/3 | | 9⅛ | 10⅝ | 4 4 6 | 51/3 | 35/6 |
| Marryat & Scott | 2/- | 5/3 | | 22½ | 22½ | 8 11 6 | 6/3 | 5/1 |
| Mather & Platt | £1 | 53/6 | | 12½ | 15 | 5 12 3 | 53/10 | 41/3 |
| Metal Industries | £1 | 42/- | +9d | 15 | 12* | 5 14 3 | 47/9 | 37/9 |
| Midland Elec. Mfg. | £1 | 62/6 | | 15 | 15 | 4 16 0 | 63/9 | 56/3 |
| Morphy Richards | 4/- | 16/3 | | 40 | 40 | 9 17 0 | 16/3 | 13/- |
| Murex | £1 | 52/6 | | 15 | 15 | 5 14 3 | 60/9 | 50/6 |
| Newman Ind. | 2/- | 2/6 | | 10 | 10 | 8 0 0 | 2/10 | 2/- |
| Oldham & Son | 1/- | 2/9 | | 35 | 17½* | 6 7 3 | 2/10 | 2/2 |
| Parnall (Yate) | 5/- | 4/9 | | 6 | 6 | 6 6 3 | 4/9 | 2/6 |
| Parsons, C. A. | £1 | 38/3 | | 10* | 12½ | — | 48/- | 27/9 |
| Plessey | 5/- | 40/- | +1/- | 25 | 30 | 3 15 0 | 37/- | 20/1 |
| Pye Deferred | 5/- | 16/- | | 18 | 20 | — | 16/3 | 10/6 |
| Revo | 10/- | 17/- | | 27½ | 27½ | — | 17/6 | 13/11 |
| Reyrolle | £1 | 67/6 | +1/3 | 10* | 12½ | — | 79/- | 51/- |
| Richardsons Westgarth | 5/- | 9/3 | | 12 | 15 | 8 2 3 | 11/1 | 8/6 |
| Scottish Cable | 4/- | 13/3 | | 32 | 20* | 6 0 9 | 13/3 | 11/1 |
| Siemens Ord. | £1 | 35/- | | 10 | 10 | 5 14 3 | 37/- | 31/6 |
| S. Smith (England) | 4/- | 12/6 | | 12½ | 15 | 4 16 0 | 12/6 | 7/11 |
| Southern Areas | £1 | 18/9 | | 5 | 6 | 6 8 0 | 19/7 | 10/3 |
| Strand Elec. | 5/- | 7/6 | | 17½ | 17½ | 11 13 3 | 10/- | 7/9 |
| Sturtevant | 5/- | 30/- | +1/- | 17½† | 18·1†* | — | 29/9 | 20/10 |
| Sun Elec. | £1 | 25/- | | 15 | 15 | 12 0 0 | 27/- | 24/6 |
| Switchgear & Cowans | 5/- | 12/6 | | 22½ | 22½ | 9 0 0 | 16/9 | 12/6 |
| Taylor, T. | 5/- | 12/3 | | 20 | 25 | 5 2 0* | 12/3 | 9/6 |
| T.C.C. | 10/- | 42/6 | | 20 | 20* | — | 42/6 | 31/5 |
| T.C. & M. | £1 | 31/6 | | 10 | 8½* | 5 8 0 | 31/6 | 25/6 |
| Telephone Mfg. | 5/- | 7/6 | | 10 | 10 | 6 13 3 | 9/4 | 7/1 |
| Thorn Elec. | 5/- | 13/6 | | 12½ | 12½ | 4 12 6 | 14/- | 7/10 |
| Thornycroft | £1 | 35/- | +1/9 | 15 | 15 | 8 11 6 | 54/- | 29/9 |
| Tube Investments | £1 | 62/6 | | 15* | 15 | 4 16 0 | 71/9 | 54/- |
| Vactric | 5/- | 8/9 | | Nil | Nil | Nil | 10/3 | 3/6 |
| Veritys | 5/- | 5/- | | 7½ | 10 | 10 0 0 | 5/4 | 4/1 |
| Wallsall Conduits | 4/- | 44/6 | −6d | 70 | 70* | 6 5 9 | 47/6 | 43/9 |
| Ward & Goldstone | 5/- | 42/6 | −2/- | 45 | 45* | 5 5 10 | 46/- | 29/9 |
| Watford | 2/- | 4/9 | | 25 | 25 | — | 5/6 | 4/10 |
| Westinghouse Brake | £1 | 62/- | +3d | 14 | 15 | 4 16 9 | 64/- | 51/3 |
| West, Allen | 5/- | 12/9 | | 15 | 15 | 5 17 9 | 14/4 | 10/3 |
| Wolf Electric | 5/- | 11/- | | — | 15 | 6 16 3 | 12/8 | 9/6 |
| *Trusts, Transport and Communications* | | | | | | | | |
| Anglo-Am. Tel.: | | | | | | | | |
| A Ord. | 100 | 83½ | | — | 6 | 7 3 9 | 91 | 77 |
| Ord. | 100 | 52½ | −5 | — | 3¾ | 7 2 10 | 57½ | 53 |
| Anglo-Portuguese | £1 | 21/9 | | 8 | 8 | 7 7 3 | 23/9 | 20/1 |
| Brit. Elec. Traction: | | | | | | | | |
| Def. Ord. | 5/- | 40/6 | +1/- | 25 | 35 | 4 6 6 | 39/6 | 21/3 |
| Cable & Wireless: | | | | | | | | |
| Ord. | 100 | 146 | | 8 | 8 | 5 9 6 | 148 | 124 |
| 4% Let | 100 | 96½ | | 4 | 4 | 4 3 0 | 97½ | 93 |
| Calcutta Trams | £1 | 19/3 | −6d | 6† | 2½†† | — | 23/6 | 16/- |
| Cape Elec. Trams | £1 | 13/- | | 5½ | 5½ | 8 9 3 | 13/- | 9/- |
| Marconi Marine | £1 | 28/9 | | 10 | 10 | 6 19 2 | 31/6 | 26/9 |
| Oriental Tel. Ord. | £1 | 75/- | | 16 | 16 | — | 75/- | 59/- |
| Telephone Props. | £1 | 4½ | +5/- | 8 | 8 | — | 126/3 | 33/- |
| Telephone Rentals | 5/- | 9/6 | +3d | 10 | 10* | — | 10/- | 6/8 |

### Electrical Apparatus Co.

The 5s ordinary shares of the Electrical Apparatus Co. were introduced to the market towards the end of last month, and are now quoted around 12s 6d, ex a 20 per cent share bonus. A dividend of 20 per cent is being paid for the year to July last, and the company has announced the intention of recommending the same rate, subject to unforeseen events, for the current period. The prospective yield on the shares is thus 8 per cent. At last week's annual meeting the chairman gave a good account of current business and thought that, in the absence as aforesaid, of untoward events, excellent results should be shown again next year.

### Dividends to Come

January is a comparatively quiet month so far as company dividend declarations are concerned, but if last year's precedent is followed, the electrical market will hear the Aberdare Cable (Holdings) announcement about the end of the month. A year ago, the company declared a second interim (ranking as a final) of 15 per cent, making 25 per cent for the year, or 5 per cent more than the previous total. Since then, a share-for-share bonus has been distributed. The latest period, which ended in October, was reported to have opened well, and the company was expecting satisfactory business once the uncertainty over copper prices had been clarified. If the rate of the final dividend now due is reduced, as the interim was, in proportion to the doubling of the capital, the total for the year will be 12½ per cent, and the yield on the 5s shares, at 8s 6d, close on 7½ per cent.

### Preference Shares

The recently issued Ferranti 5 per cent second preference shares will be available free of stamp for a few more days to come, and can be bought in

fairly large numbers at 20s 6d, to yield £4 17s 6d per cent. It remains difficult to secure a full 5 per cent on the money, from first-grade shares in this category, except from the higher priced and correspondingly less popular issues. G.E.C. 7½ per cent preference are a case in point, the yield at 30s being just 5 per cent, while the same company's 4¼ per cents, a junior ranking stock, give no more than 4·6 per cent at the offered price of 18s 6d. Crompton Parkinson " sixes " are occasionally on offer at about 24s, to give 5 per cent.

# REPORTS and DIVIDENDS

**The Electrical Apparatus Co., Ltd.**—Presiding at the annual meeting held on 8th January, Mr. R. H. Barbour (chairman), said that the past year had seen the change of the company from a privately-owned concern to a public company. Changes in the directorate included his relinquishment of the position of governing director, and the appointment of Mr. C. F. Jackson to the board. Mr. Jackson would continue in charge of control gear sales. The profit for the year showed a substantial advance on that of the preceding year; this was due to materials having been easier to procure, so that it was possible for their production to proceed on a smoother and larger scale. Their rapid dispatch service which enabled them to supply many standard products at short notice was proving popular, while for other products, they had an order book of ample size to allow of comfortable planning and production. Orders had shown a tendency in the last few months to recover from the drop that occurred when the Korean boom ended, and in the absence of any untoward circumstance, excellent results should be shown again next year. Referring to E.A.C. Canada, Ltd., Mr. Barbour said they had designed special lines for the Canadian market. On the research and design side, much work had been done on the development of new products.

**The Palestine Electric Corporation, Ltd.**—The Jerusalem Correspondent of the *Financial Times* reports that the final plan for the participation of the Israel Government in the Corporation was accepted on 10th January at the weekly Cabinet meeting. The plan constitutes an offer by the Government to purchase 2,800,000 shares registered in London at a price of 29s 6d per share. This sum is to be paid in 15 annual instalments begining 1st October next, bearing 4 per cent interest. Payment for the 1,080,000 shares registered in Israel is to be made in the form of a Government dollar bond to the value of £1 (sterling), plus the equivalent of approximately 5s per share in cash. The offer appears to concern only ordinary shares.

**Marco Refrigerators, Ltd.,** reports a group trading profit for the year to 30th September last of £7,151, as compared with a loss of £6,820 for the preceding year, and a net profit of £316 (against a net loss of £13,772), subject to tax of £1,118. There is a tax refund of £6,124. The preference dividend is paid, but there is no ordinary dividend. Mr. A. E. Leach (chairman), states that there has been a sustained upswing in demand and output since the commencement of the current financial year, and the directors feel confident that given a fair chance action taken to boost demand will show satisfactory and profitable results.

**W. Canning & Co., Ltd.**—Application is being made to the Capital Issues Committee for permission to capitalize £300,000 of reserves by the issue to ordinary shareholders of 1,200,000 ordinary shares of 5s each.

**W. H. Allen, Sons & Co., Ltd.,** have declared an interim dividend of 5 per cent (unchanged).

**Greenwood & Batley, Ltd.,** are paying an interim dividend of 5 per cent (unchanged).

## New Companies

**Norwest Electrical, Ltd.**—Registered 9th December. Capital £1,000. Electrical engineers and contractors, manufacturers of radio apparatus, etc. Secretary: T. A. Herbert.

**J. Edward Hall (Elec. Engineers), Ltd.**—Registered 15th December. Capital £20,000. Electrical, mechanical and general engineers, etc. Directors: Wm. Triffitt, J. E. Hall and J. H. Hyde. Secretary: J. E. Hall. Regd. office: Clarence Road Works, Leeds, 10.

**Klee's, Ltd.**—Registered 12th December. Capital £100. Industrial, commercial, wholesale and retail electricians, electrical contractors, radio and television engineers, etc. Directors: G. R. T. Klee and B. J. Freeman. Regd. office: 566, Stratford Road, Sparkhill, Birmingham.

**Minelec, Ltd.**—Registered 3rd December. Manufacturers of and dealers in all kinds of mineral and chemical substances and materials used in the electrical industry or for electronic purposes, etc. Directors: B. Richardson and Z. M. Banks. Regd. office: 38/9, Bruton Street, W.1.

## Bankruptcies

**J. H. Bourne,** carrying on business under the style of the Amplifier Illumination Co., at Rayleigh Works, Powlett Street, Wolverhampton, electrical fittings and fancy goods manufacturer, and also trading in partnership with another under the style of E. Desborough & Sons, at the same address as electro platers.—Supplemental dividend of 1¼d in the £, payable at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

**A. F. Ayres,** 104, Bridgwater Drive, Westcliff-on-Sea, electrical contractor.—Receiving order made 30th December on debtor's own petition.

**B. T. Smith,** carrying on business at the Studio, Ramsgate, Louth, Lincs., electrical engineer and contractor.—Trustee, Mr. L. F. McCulloch, 26, South St. Mary's Gate, Grimsby, appointed 1st January.

**D. G. Edwards,** carrying on business at 8, Blackfriars Road, Newcastle-under-Lyme, electrical engineer.—Trustee, Mr. F. C. Ormrod, 12, Lonsdale Street, Stoke-on-Trent, released 30th December, 1953.

**R. Jackson,** residing at 5, Romney Avenue, Dalton-in-Furness, Lancs., lately carrying on business at 38, Walley Range, Blackburn, electrician. Supplemental dividend of 16s 5½d in the £ (making 20s in the £) plus 4 per cent statutory interest, payable at the Official Receiver's office, 14, Lowther Street, Carlisle.

# TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 6th February:—

HED LTD. (design). No. B707,125, Class 9. Electric current transformers; rectifiers; electric arc welding apparatus and current control apparatus for use therewith; electric contact devices; and magnetizing apparatus (not being machines).—Hirst Electronic Development, Ltd., Eastdown Works, Dermody Road, London, S.E.13.

HELIOWATT (design). No. 717,943, Class 9. Meters, electric time switches and electrical apparatus for use in controlling the reactive power in electrical circuits.—Heliowatt Werke Elektrizitäts Aktiengesellschaft, Berlin-Charlottenburg, Germany. Address for service, c/o G. F. Redfern & Co., Redfern House, Dominion Street, London, E.C.2.

No. 720,080 (design), Class 9. Radio and television sets, gramephones and talking machines.—Mohamed Husain Ismail, Third Floor, 60, Newman Street, London, W.1.

D MAXI-Q (design). No. 720,798, Class 9. Scientific and electrical apparatus and instruments, all included in Class 9; radio instruments and apparatus, electronic signalling instruments and apparatus; and talking machines.—Denco (Clacton), Ltd., 355 to 359, Old Road, Clacton-on-Sea, Essex.

ELLISON. No. 721,284, Class 9. Junction boxes, branch boxes, circuit breakers, apparatus for use in operating machines, engines and motors by current control, distribution boards, relays, resistances, fitted switchboards and transformers, all being electrical goods.—George Ellison, Ltd., Wellhead Lane Works, Wellhead Lane, Perry Barr, Birmingham, 22.

SEN TER CET (design). No. B721,056, Class 9. Electric current rectifying instruments and apparatus.—Standard Telephones & Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

BETROLITE. No. 723,997, Class 9. Insulated electric cables, wires, and parts included in Class 9 of electrical apparatus and instruments, all made of plastics.—The L.P.S. Electrical Co., Ltd., Ealing Road, Alperton, Middlesex.

AREXONE. No. 724,105, Class 9. Insulated electric wire and electric cables.—Arex, Ltd., 17, Irving Street, London, W.C.2.

CATS-EYE. No. B724,203, Class 9. Luminous devices for use in indicating the position of electric switches.—Barbara Lilian Burgess, 11, Pepys Road, Wimbledon, London, S.W.20.

FORTAC. No. 724,253; MOLY-FLEX. No. 724,257; VITRAC. No. 724,259. All Class 9. Electrodes for electric welding.—Rockweld, Ltd., Commerce Way, Croydon, Surrey.

# NEW ELECTRICAL EQUIPMENT

## Power Control Unit

AN INHERENTLY SAFE and convenient means of obtaining both a.c. and d.c. supplies at low voltage (12–15 V) for small mechanisms is provided by the A3 power control unit made by MECCANO, LTD., Binns Road, Liverpool. It comprises an aluminium alloy case housing a double-wound transformer having two isolated secondary windings, one of which gives an output of 15 V at 1 A. The other secondary feeds a bridge-connected metal rectifier the d.c. output of which is split into two circuits, the first giving an output of 12 V at 0·9 A at fixed polarity, and the second an alternative d.c. supply which is controlled from zero to a maximum of 12 V at 10 W. The polarity of this latter supply can be reversed.

A toroidally-wound control resistance and special reversing switch are incorporated into a single component fitted with a handle type control for ease of operation. Overload protection is given to both d.c. circuits by a magnetic type current limiter, which is normally set for 30 per cent overload, and a feature of this device is the consistency of the operating current setting. Standard units are suitable for operation from supplies of 210–250 V, 50–80 c/s, and units for special supply voltages and frequencies are available. Radio interference suppression is included in all units, which have been designed to a most stringent specification, including the special requirements of the Canadian Standards Association.

## Hydrogen and Oxygen Indication

An instrument for the accurate and continuous measurement of small quantities of oxygen or hydrogen in mixtures of these two gases, or separately in other inert gases, has been developed by BAKER PLATINUM, LTD., 52, High Holborn, London, W.C.2. It is based on the measurement of the heat of combination of oxygen and hydrogen and employs a catalyst similar to that used in the company's "Deoxo" purifiers. It is thus necessary when measuring oxygen to have at least a slight excess of hydrogen (or of oxygen if hydrogen is being measured). The catalyst is in a vacuum-jacketed calorimeter, and a multi-junction thermocouple measures the difference in temperature between the incoming and outgoing gas. Thus, an e.m.f. is produced, which enables continuous indication and, if required, a record to be obtained. Although all the gas being measured is combined on the catalyst, the indicated temperature rise is significantly below the theoretical figure. This is accounted for by heat losses; but, by controlling the flow at a predetermined figure, reliable reproducible results are obtained.

To calibrate the instrument the inlet gas is first passed through a "Deoxo" purifier (built in the instrument for the purpose), and then known quantities of oxygen and/or hydrogen are added by a small electrolytic cell, before passing to the calorimeter. The electrical output of the instrument is directly proportional to the oxygen or hydrogen content of the gas, so calibration at one point only is required. The indicated temperature rise compared with the theoretical is about 65 per cent, but this figure is not important so long as it remains substantially constant. For calibration it is necessary to control the gas flow rate accurately, but in use a variation of ± 10 per cent does not affect the reading significantly. A sensitivity adjustment enables the indicator reading to correspond directly with the oxygen or hydrogen content. The instrument covers the range 0·01 per cent up to 1 per cent oxygen with good accuracy, and can, with decreasing accuracy, be made to indicate down to as low as 0·001 per cent.

## Earth Leakage Circuit Breakers

An earth leakage circuit breaker designed to conform with B.S. 842 : 1939 and Regulation 404J of the I.E.E. Wiring Rules has been developed by SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38–39, Upper Thames Street, London, E.C.4. This improved design embraces a robust tripping mechanism which is unlikely to be affected by variations of temperature, dampness or ingress of dust, etc.

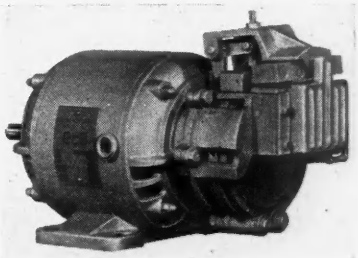
The trip coil operates at 24 V leakage potential, at which voltage the armature is brought into the field of a strong permanent magnet which exerts the pull which trips the mechanism. All parts are of sturdy construction and heavily protected; the case consists of a robust Bakelite moulding with separate extended terminal covers for use with t.r.s. cable or conduit.

Provision is made for adding differential coil overload protection, two sizes of coil being available. The standard is 45 A but a 30 A coil can be supplied. The circuit breaker is suitable for use as a consumers' main switch in small dwellings, particularly in rural areas where low resistance earth connections are unobtainable. In addition it can be used for the protection of farm equipment, small motors, small tools and other industrial applications.

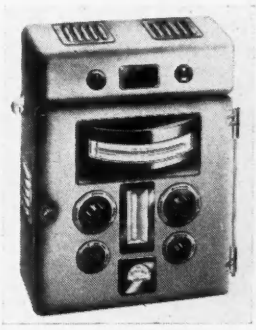
## Magnetic Brake

The 4in magnetic brake made by BROOK MOTORS, LTD., Empress Works, Huddersfield, is suitable for integral mounting to electric motors because of the inherent interlocking which exists when the brake is energized from the same supply as the motor. The brake is normally "on" when the current is off and when the motor is running it is held in the "off" position. Thus any interruption to the supply automatically leads to application of the brake.

It can be offered with "Gryphon Cub" motors, the price including the flange on the motor, the shaft extension for the brake and the brake drum, as well as the fitting of the brake and the wiring from the motor terminal board to the brake terminals. The brake is also available as an independent unit. The available voltage ranges of the magnet coils are 200–250 V a.c. and 350–440 V a.c.



*Brook 4in magnetic brake*



*Left: Meccano power control unit. Centre: Baker Platinum "Deoxo" indicator. Right: Siemens earth leakage circuit breaker*

# NEXT WEEK'S EVENTS

*Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged*

### Monday, 18th January

BIRMINGHAM.—Midland Hotel, 6.15 p.m. Birmingham Electric Club. Film night.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Some Researches on Circuit-Breaking by means of High-Voltage Circuit-Breakers with special reference to Current-Chopping," by A. F. B. Young.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "The Role of the Consulting Engineer," opened by T. G. N. Haldane.

Northampton Polytechnic, St. John Street, E.C.1, 6 p.m. Institute of Metal Finishing, London Branch. "Some Aspects of Tinning by Immersion Processes," by D. E. Weimer and J. W. Price.

85, Minories, E.C.3, 6.30 p.m. Institute of Marine Engineers. "Turbines," by John Brown.

NEWCASTLE - ON - TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurements Group. Discussion on "Will Transistors Oust Receiving Valves?" opened by E. H. Cooke-Yarborough.

RENFREW.—Institute of Metals, Scottish Local Section. Visit to the Research Laboratories of Babcock & Wilcox, Ltd.

STOKE-ON-TRENT.—Electricity Showrooms, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Domestic Electrical Installations: Some Safety Aspects," by H. W. Swann.

### Tuesday, 19th January

BIRMINGHAM.—Imperial Hotel, 6.30 p.m. Engineers' Guild, West Midland Branch. "Statutory Registration of Engineers," by P. St. L. Lloyd.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Design Features of Certain British Power Stations," by S. D. Whetman and A. E. Powell.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "The Royal Festival Hall: Electrical Installation," by J. G. Hunter.

LIVERPOOL.—North Wales E.B., Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Industrial Colour Matching Problems," by A. Wilcock.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements Section. Discussion on "High-Sensitivity Wattmeters," opened by Dr. A. H. M. Arnold.

2, Savoy Hill, 6.30 p.m. Association of Supervising Electrical Engineers. "Railway Signalling," by J. P. Coley.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "Technical Colleges and Education for the Electrical Industry," by Dr. H. L. Haslegrave.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilization Group. Discussion on "This Question of Power Factor," opened by G. Knights.

### Wednesday, 20th January

BIRMINGHAM.—Midland Institute. I.E.E. South Midland Centre. "Land Reclamation in England and Holland," by W. H. Haile. (Joint meeting with Midlands Association, I.C.E., and Midlands Branch, I.Mech.E.)

BRISTOL.—Grand Hotel, 7.15 p.m. Incorporated Plant Engineers, Western Branch. "Some Aspects of Engineering Practice and Education," by Prof. J. L. M. Morrison.

DUNDEE.—Royal British Hotel, 7.30 p.m. Institution of Engineering Inspection, Dundee Branch. "Manufacture of Gauges and Measuring Instruments," by J. B. Perry.

EDINBURGH.—The University, 7 p.m. British Institution of Radio Engineers, Scottish Section. Film evening.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Design Features of Certain British Power Stations," by S. D. Whetman and A. E. Powell.

425/427, Sauchiehall Street, 7 p.m. Incorporated Plant Engineers, Glasgow Branch. "Instrumentation."

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "The Teaching of Magnetic Materials," opened by Prof. F. Brailsford.

Café Royal. I.E.E. Utilization Section. Dinner-dance.

Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Engineers, London Centre. Informal meeting. "Facilities and Novel Features of the Standard P.A.B.X.," by P. E. Pettimore and W. Sheldon.

Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "The Development of Germanium Crystals," by Mr. Betteridge.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institution, Corporation Road, 6.30 p.m. I.E.S. Tees-Side Group. "Lighting of Rail Grids and Marshalling Yards," by K. Graham. Followed by a visit to Dorman Long & Co.'s works.

NOTTINGHAM.—E.M.E.B., Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. "Industrial Switchgear," by A. T. Crawford and W. Fenwick.

OXFORD.—S.E.B., 37, George Street, 7 p.m. Institution of Electrical Engineers, District meeting. "Heat Pumps," by Miriam V. Griffith.

PRESTON.—19, Friargate, 7.15 p.m. I.E.S. North Lancashire Group. "A Contractor's Lighting Problems," by R. E. Wolstenholme.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "Colour Television," by L. C. Jesty.

SOUTHAMPTON.—"Pilgrim Room," Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. "An Introduction to High Frequency Heating," by R. J. Webb.

Technical College, 6.30 p.m. I.E.E. Southern Centre. "A.c. on Ships," by B. C. Pyle.

STAFFORD.—At the English Electric Co.'s Lecture Theatre, 7.15 p.m. I.E.E. North Staffs. Students' Section. "Automatic Telephony and a Works Telephone Exchange," by N. D. Hyde.

STOCKTON-ON-TEES.—Vane Arms Hotel, 7.30 p.m. Institution of Works Managers, Tees-Side Branch. "The Development of Industrial Tees-Side," by J. C. H. Booth.

WIMBLEDON.—Guild House, 32, Worple Road, 8.15 p.m. A.S.E.E. South West London Branch. Branch lecturettes.

### Wednesday, 20th January, to Friday, 29th January

LONDON.—Olympia. Hotel, Restaurant and Catering Exhibition.

### Thursday, 21st January

BIRMINGHAM.—Imperial Hotel, Temple Street, 6.30 p.m. Institute of Metals, Birmingham Local Section. "The Philosophy of Science," by Prof. S. Toulmin.

BLACKBURN.—Grosvenor Hotel, Lord Street, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "Power Factor Correction," by C. W. Sutcliffe.

BRADFORD.—45–53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Glassware in the Lighting Art," by M. Keenan.

CARDIFF.—Park Hotel. South Wales Institute of Engineers. Annual dinner.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 7 p.m. British Institution of Radio Engineers, Scottish Section. Film evening.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Utilization Section. "Electricity in the Wool Textile Industry," by A. J. Francis and T. H. Carr.

164, Shaftesbury Avenue, W.C.2, 7 p.m. Television Society. "American Television," by J. Sieger.

Caxton Hall, Westminster, 2.30 p.m. Diesel Engine Users' Association. "Operating Experience with Gas Turbines with particular reference to the Beznau Plant," by E. A. Kerez.

The Polytechnic, Regent Street, 7.30 p.m. Institute of Welding, North London Branch. "Steel Making and Welding," by Dr. L. Reeve.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Institution of Mechanical Engineers, North Western Branch. "The History and Development of Flexible Couplings for the Transmission of Power between Rotating Shafts," by A. Flindle.

TONBRIDGE.—Bridge Café, 32, High Street, 8 p.m. A.S.E.E. Kent Branch. Lecture.

### Friday, 22nd January

COVENTRY.—Coventry Electric Club. Annual dinner and dance.

DONCASTER.—Danum Hotel, 7 p.m. Institution of Works Managers, Doncaster Branch. Dinner and social evening.

LEEDS.—Queen's Hotel. Incorporated Plant Engineers, West and East Yorks Branch. Annual dinner and dance.

LONDON.—Townsend House, Greycoat Place, S.W.1, 7 p.m. Junior Institution of Engineers. "Some Aspects of the Issue of Technical Information to Industry," by J. C. Y. Baker.

Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. "On the Graphical Solution of Transient Vibration Problems," by Dr. R. E. D. Bishop.

NEWCASTLE-UPON-TYNE.—King's College, 7.15 p.m. North East Metallurgical Society. "Evolution in Extraction Metallurgy," by Prof. C. W. Dannatt.

SOUTHAMPTON.—The University, 7.30 p.m. E.P.E.A. Southampton Technical Group. "The British 275 kV System," by F. J. Lane.

WEYMOUTH.—Technical College, 6.30 p.m. I.E.E. Southern Centre. District meeting. "Radar Echoes from the Moon and Aurora," by I. A. Gatenby.

## Peat Conference

DELEGATIONS from Britain, Norway, Sweden, Finland, Denmark, Iceland, Holland, Germany, Canada, the United States, France, and Switzerland are expected to attend Ireland's First International Peat Symposium to be held in Dublin from 12th to 17th July next. The scope of the discussions will be wide, and the papers to be read include such subjects as open-cycle peat-fired gas turbines, excavating methods, gasification of peat, and domestic uses of peat. A member of each delegation will submit a paper on general developments in his own country.

# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 24th February from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

**1949**

25224. General Electric Co., Ltd., Dudding, R. W., Mackenzie, R. B., and Welch, E. E.—Methods of applying thin layers of metal on insulating surfaces. 11th December, 1950. (704451.)

28923. Thornley & Knight, Ltd., and Taylor, C. J. A.—Electrostatic deposition of finely divided substances. 12th February, 1951. (704663.)

30785. British Broadcasting Corporation, Bliss, J. L., and Worswick, T.—Coupled optical viewfinders for television and other cameras. 29th November, 1950. (704381.)

**1950**

6518. Radio Corporation of America.—High-power electron-discharge device. 15th March, 1950. (704532.)

6918. Devaux, R.—Fuel economizers using electric sparks for petrol engines and the like. 20th March, 1950. (704606.)

11223. Edison Swan Electric Co., Ltd.—Manufacture of cathode-ray tubes. 3rd May, 1951. (704533.)

12108. Electro-Hydraulics, Ltd.—Industrial fork-lift trucks. 31st May, 1951. (704666.)

18260. Uher, E. (trading as Uher & Co., Ges. für Apparatebau).—Electromagnetic switch relays. 21st July, 1950. (704387.)

26285. British Insulated Callender's Cables, Ltd.—Web-tensioning devices. 26th October, 1951. (704672.)

27821. Ohio Crankshaft Co.—Electric induction heating of strip material. 14th November, 1950. (704389.)

28795. Smart & Brown (Engineers), Ltd.—Devices for mounting fittings, such as electric lamp fittings on ceilings or the like. 23rd November, 1951. (704540.)

28977. Du Mont Laboratories, Inc., A. B.—Electron gun structure. 27th November, 1950. (704612.)

29363. Switchgear & Equipment, Ltd., and Sharples, F. A.—Hand operated mechanism for electric switchgear. 28th November, 1951. (704613.)

30227. Ayers, F. L., and Grimshaw, J. P.—Switch actuating mechanism for controlling the operation of apparatus fed with sheets of paper and like material. 17th October, 1951. (704675.)

**1951**

407. Pye, Ltd.—Television transmitting apparatus. 18th December, 1951. (704676.)

1199. Soc. des Accumulateurs Fixes et de Traction.—Negative electrodes for alkaline storage batteries. 16th January, 1951. (704461.)

1943. Laurence, Scott & Electromotors, Ltd., Schwarz, B., and Cook, A.—Rotors of a.c. electric machines, more especially squirrel cage rotors. 22nd January, 1952. (704462.)

2250. Sylvania Electric Products, Inc.—Cold cathode gas-filled diode. 29th January, 1951. (704660.)

2315. Plessey Co., Ltd.—Plug-and-socket connector for multiple electric wiring systems. 30th April, 1952. (704464.)

3811. Siemens Bros. & Co., Ltd.—Electrical control networks. 15th February, 1952. (704465.)

4117. Electric & Musical Industries, Ltd.—Cathode-ray tubes having ion trap arrangements. 13th February, 1952. (704543.)

5517. British Thomson-Houston Co., Ltd.—Resonator structures in synchrotrons and the like. 7th March, 1951. (704392.)

5744. Ges. für Elektrische Zugbeleuchtung.—Electric voltage regulators, particularly for train lighting plants. 9th March, 1951. (704466.)

6889. English Electric Co., Ltd.—Elastic-fluid turbine installations. 14th March, 1952. (704467.)

7375. Villiers Engineering Co., Ltd., and Ireland, W. F.—Combined ignition, lighting and battery-charging circuits for internal-combustion engines. 28th March, 1952. (704546.)

7934. English Electric Co., Ltd.—Blocking oscillator circuits. 4th April, 1952. (704469.)

7936. English Electric Co., Ltd.—Braking systems for hoists and the like. 28th March, 1952. (704470.)

8631. Soc. d'Applications et de Fabrications Industrielles S.A.F.I.—Voltage-regulators for alternators. 13th April, 1951. (704683.)

9316. Etablissement Velga.—Frequency modulated oscillating circuits and condenser microphones. 20th April, 1951. (704473.)

10082. British Thomson-Houston Co., Ltd.—Electric-discharge devices. 30th April, 1951. (704551.)

12655. Raupach, F.—Electric switches for the regulation of electrical apparatus. 30th May, 1951. (704686.)

12740. Metropolitan-Vickers Electrical Co., Ltd.—Construction of electric motors. 2nd April, 1952. (704555.)

13947. Cinch Manufacturing Corporation.—Sockets for thermionic valves, electrical plugs and like electrical devices having projecting prongs. 12th June, 1951. (704623.)

14493. Westinghouse Brake & Signal Co., Ltd., Jenkins, A., and Smith, C. H.—Manufacture of dry surface contact rectifiers. 18th June, 1952. (704398.)

15788. Quasi-Arc Co., Ltd., Mitchell, E. J., Swan, A. H. B., and Barber, B. K.—Welding electrodes. 12th June, 1952. (704402.)

16254. Telefonaktiebolaget L. M. Ericsson.—Systems for indicating the passage of vehicles over roadways. 9th July, 1951. (704476.)

16372/3. Hutchins Electric Co., Inc.—Electric motor. 10th July, 1951. (704626/7.)

19110. Brush Development Co.—Electro-acoustic device. 14th August, 1951. (704633.)

21801. Babcock & Wilcox, Ltd.—Tubulous vapour generating and superheating units. 17th September, 1951. (704479.)

23080. Metropolitan-Vickers Electrical Co., Ltd.—Control of electrically-operated hoists and winders. 1st May, 1952. (704481.)

23828. Philips Electrical Industries, Ltd.—Discharge tubes comprising a metallic exhaust tube and method of finishing hermetically pinched, metallic exhaust tubes of discharge tubes. 12th October, 1951. (704408.)

23938. Strong, C. L.—Apparatus for carrying out electro-therapeutic treatments. 9th September, 1952. (704482.)

23968. Igranic Electric Co., Ltd.—Control systems for electric motors. 15th October, 1951. (704700.)

24357. General Electric Co., Ltd., and Hubbold, S.—Lighting fittings. 1st October, 1952. (704409.)

25117. Uher, E. (trading as Uher & Co. Ges. für Apparatebau).—Electromagnetic switch relays. 21st July, 1950. Divided out of 704387. (704412.)

25690. Scintilla, Ltd.—Electric starting motors for internal-combustion engines. 2nd November, 1951. (704483.)

26497. Johnson, G.—Electrically-heated device for lighting solid-fuel fires. 11th September, 1952. (704484.)

26999. Lignes Télégraphiques et Téléphoniques.—Magnetically loaded high frequency transmission lines. 16th November, 1951. (704487.)

27286. Plessey Co., Ltd.—Device for longitudinally slitting the coverings of electric cables. 12th November, 1952. (704488.)

27327. British Thomson-Houston Co., Ltd.—Clothes washing machines. 21st November, 1951. (704643.)

29216. Reyrolle & Co., Ltd., A.—Electric contacts. 12th December, 1952. (704420.)

30134. Burndept, Ltd.—Electric dry batteries. 24th December, 1952. (704708.)

**1952**

290. General Electric Co., Ltd., and Sanderson, R. W. W.—Electric primary cells. 5th January, 1953. (704710.)

732. Hanovia Chemical & Manufacturing Co.—Electric discharge lamps. 9th January, 1952. (704582.)

856. Parsons, Ltd., C. H., and Handley, G. B.—Electric fuse holders. 2nd December, 1952. (704423.)

1288. Babcock & Wilcox Tube Co.—Normalizing electrically welded tubing in line of production. 16th January, 1952. (704712.)

3137. Thornton, A. A. (Ferro Enamel Corporation).—Electric smelter for producing porcelain enamel frit. 6th February, 1952. (704713.)

3549. Akt.-Ges. für Unternehmungen der Eisen- und Stahlindustrie.—Arrangement for compensating voltage fluctuations in an a.c. network. 11th February, 1952. (704426.)

3684. Philips Electrical Industries, Ltd.—Devices for sectional radioscopy. 12th February, 1952. (704586.)

4638. Weissbrem, E.—Electrically heated boiling pans. 21st February, 1952. (704431.)

4843. Hoover, Ltd.—Suction cleaners. 25th February, 1952. (704432.)

4967. Westinghouse Electric International Co.—Induction heating apparatus. 26th February, 1952. (704434.)

6427. British Thomson-Houston Co., Ltd.—Production of hollow glass vessels. 24th February, 1953. (704718.)

8087. Dowling, P.—Hydro-electric power plant. 31st March, 1952. (704502.)

8418. Askania-Werke Akt.-Ges.—Magnetometers. 2nd April, 1952. (704570.)

11675. Automatic Electric Laboratories, Inc.—Automatic telephone systems provided with toll recording facilities. 8th May, 1952. (704441.)

11762. Westinghouse Electric International Co.—Amplifiers. 9th May, 1952. (704592.)

13153. Steatit-Magnesia Akt.-Ges.—Production of ceramic condensers in slab form. 23rd May, 1952. (704727.)

13292. Siemens & Halske Akt.-Ges.—Storage arrangements particularly for type printing telegraph apparatus with storage of the signals to be transmitted. 26th May, 1952. (704594.)

15711. Eichstadt, F. J. W., and Ellis, K. W.—Device for topping up electric accumulators with water. 23rd June, 1952. (704515.)

16692. British Dielectric Research, Ltd.—Electric capacitors. 2nd July, 1953. (704728.)

17599. Telefonaktiebolaget L. M. Ericsson.—Audio-frequency signalling systems. 11th July, 1952. (704650.)

18393. Spodig, H.—Magnetic separator. 21st July, 1952. (704597.)

22155. Electrolux Corporation.—Suction cleaners. 3rd September, 1952. (704731.)

23077. Fairweather, W. C. (Singer Manufacturing Co.).—Ventilation of dynamo-electric machines. 15th September, 1952. (704734.)

23210. Standard Telephones & Cables, Ltd. —Time delay electric switching apparatus. 16th September, 1952. (704651.)

23970. Philips Electrical Industries, Ltd.—Radio transceivers tunable to different communication channels. 24th September, 1952. (704598.)

27480. Grosz, E.—Photo-electric sorting machines. 31st October, 1952. (704599.)

29108. Philips Electrical Industries, Ltd.—X-ray tubes. 18th November, 1952. (704737.)

30217. X-ray tubes comprising a liquid-cooled anode. 28th November, 1952. (704740.)

32441. General Electric Co.—Tube seals particularly for refrigerator cabinets. 22nd December, 1952. (704529.)

33124. Telefunken Ges. für Drahtlose Telegraphie.—Multiplex signalling systems. 31st December, 1952. (704530.)

**1953**

193. Cinch Manufacturing Corporation.—Sockets for thermionic valves, electrical plugs and like electrical devices having projecting prongs. 12th June, 1951. Divided out of 704623. (704658.)

# STREET LIGHTING NOTES

LAST week guests of the Yorkshire Electricity Board and of the Automatic Telephone & Electric Co., Ltd., met at the Board's Whitehall Road premises in Leeds to see the inauguration of the new "Rythmatic" system which will eventually control the whole of the street lighting of the city and which, when completed, will be one of the most extensive schemes of its kind in the country. After the visitors had been welcomed by Mr. B. D. Youatt, manager of the Board's Leeds Sub-Area, Mr. J. F. Mackenzie, technical engineer of the company, explained the operation of the system. Later the visitors were shown the control panel for switching four sections, three controlled from Whitehall Road and one at Fir Tree Lane. The panel is shortly to be transferred to the headquarters of the Street Lighting Department in Springwell Street so that the city's street lighting will be under the direct control of Mr. L. A. Doxey, Leeds street lighting engineer.

Afterwards a dinner was held at the Hotel Metropole at which Councillor A. Brown, chairman of the Street Lighting Committee, said that the present installation had been introduced in anticipation of the eventual conversion of some 19,000 gas lamps to electricity in addition to the 5,000 electric street lamps at present in existence. Other speakers included Mr. A. Haselhurst (Y.E.B.) and Mr. T. R. Rayner (Automatic Telephone & Electric Co.).

On view at the Hotel Metropole was a working model of the equipment in conjunction with an illuminated chart showing the various sections in the city controlled by the "Rythmatic" system, and it is understood that the company is presenting a similar working model to the Science Museum at South Kensington.

WATFORD Highways Committee is planning the complete lighting of the main thoroughfares in the borough at a total estimated cost of £47,441. The schemes provide for the installation of 493 lamps (411 sodium and 82 fluorescent) in substitution for 297 existing lamps. Of the 196 additional lamps 131 are to be used on the Watford By-Pass and 29 in Hampstead Road.

Street lighting along the main Birmingham–Stratford road at Shirley, criticized as inadequate for such an important area, may be improved this year. In a report to the SOLIHULL U.D.C. the surveyor states that the divisional road engineer has indicated that it may be possible to authorize a limited Class A scheme during the next financial year. The estimated cost would be approximately £7,400.

WALTHAMSTOW Corporation is to seek sanction to borrow £9,500 to cover the cost of the installation of new street lighting in North Circular Road. A scheme has also been approved in principle for the installation of traffic control signals at the junction of Hoe Street and Selborne Road.

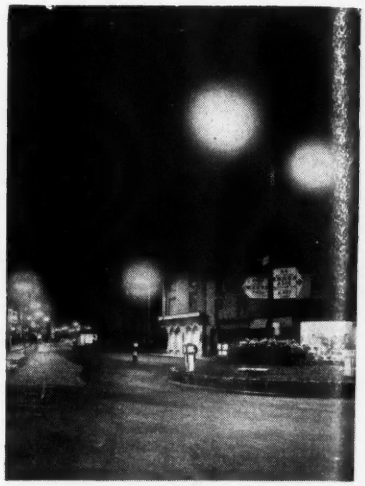
BERMONDSEY General Purposes Committee has decided to install 400 W vertical burning, side entry type, mercury vapour lamps in connection with a scheme for improving the lighting on main roads, and the borough engineer is to invite a number of specialist firms to submit tenders.

The North Eastern Electricity Board is preparing a scheme for installing fluorescent lighting on the coast road between NEWCASTLE and WHITLEY BAY.

DARLINGTON Town Council is seeking £9,600 loan sanction for the installation of sodium lighting on the North Road.

BEDFORD Corporation Highways and Sewerage Committee has submitted to the Minister of Transport for approval, a scheme estimated to cost £1,790 for the improvement of the street lighting in Clapham Road by the replacement of ten 200 W tungsten lanterns by fifteen 3/80 W fluorescent lanterns, and the conversion of two 500 W tungsten lanterns to fluorescent.

REDCAR Town Council is recommended to spend £3,150 on the provision of electric street lighting along Coatham Road and £700 on similar work in Kirkleatham Lane.



*"Mazda" fluorescent lighting in Market Harborough High Street*

Two types of light source have been used for a recent street lighting installation in MARKET HARBOROUGH. Lighting in the shopping centre is by thirty "Mazda" fluorescent lanterns, each housing three 5ft "Warm-White" fluorescent tubes, while 160 "Mazda" mercury refractor lanterns with 250 W mercury discharge lamps have been used on the other main roads. The fluorescent lanterns are mounted on steel standards painted pale green and Stanton concrete columns are used for the mercury lanterns. Special baffles have been fixed to lanterns near the railway. The contractors were the North Midland Engineering Co., Ltd.

Good progress is being made by the ASHINGTON (Northumberland) U.D.C. with a scheme for installing automatic electric street lighting throughout the district and the work is now about half completed. The scheme is costing £8,000. At present the town's 1,000 lamps are lit and extinguished by lamp lighters.

STOKESLEY (Yorks) R.D.C. has accepted the estimate of the North Eastern Electricity Board at £8,603 for providing 231 lighting units in various villages in the Council's area.

SLEAFORD U.D.C. Highways Committee has instructed the surveyor to prepare a comprehensive scheme for improving the street lighting on county roads.

LOWESTOFT Corporation Works Committee has directed the borough surveyor to report on the improvement of the lighting on the whole of the trunk road, A.12, within the borough.

New electric street lighting at SNODLAND, Kent, will cost £3,260 to install and £445 per annum to maintain. The lighting will replace the present gas lamps along a length of route A.28.

A scheme for trunk road lighting through the town is to be proceeded with by BRIGG U.D.C. as early in the year as possible.

# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.*

**Belfast.**—Electricity Department. The latest time for the receipt of tenders for telegraphs and operational telephones at Belfast power station has been extended to 29th January. (See this issue.)

12th February. Heating installation for the workshop and accommodation building at the East power station. (See this issue.)

**Belgium.** — BRUSSELS.— 19th January. Ministry of Colonies. Telephone cable and cable boxes for the Belgian Congo. (E.S.B. 13353/53. Ten/7933.)

**Carlisle.**—21st January. City Council. Electrical installations in eight shops and flats at Harraby. City engineer, 18, Fisher Street.

**Consett (Durham).**—6th February. U.D.C. One year's supply of electric lamps for street lighting. Surveyor, Council Offices.

**Edinburgh.** — North of Scotland Hydro-Electric Board. Lighting, heating and subsidiary services at Fort Augustus group control centre. (See this issue.)

Overhead transmission and distribution lines. (See this issue.)

**Egypt.** — CAIRO. — 6th February. Director General, Mechanical and Electrical Department, Ministry of Public Works. Eight transformer stations ranging from 400 to 1,600 kVA. (See this issue.)

**Friern Barnet.** — 27th January. U.D.C. Street lighting equipment. (See this issue.)

**Hythe (Kent).**—25th January. Corporation. Street lighting equipment. (See this issue.)

**India.** — BOMBAY. — 28th January. Director General of Supplies and Disposals. Electronic valves for the naval dockyard. (E.S.B. 13040/53. Ten/7918.)

NEW DELHI.—8th February. Director General of Industries and Supplies. Electric cable. (E.S.B. 13/54. Ten/7976.)

**Iraq.** — BAGHDAD. — 31st January. Directorate General of Municipalities. Two 300 kW alternator sets with transformers. (E.S.B. 13249/53. Ten/7944.)*

**Kuwait.**—1st May. Electricity Department. Two 20,000 kW turbo-alternators and two 250,000 lb/hr steam raising units. (See this issue.)

**London.**—BETHNAL GREEN.—29th January. Borough Council. Electric lamps, etc., for one year. F. H. Bristow, town clerk, Town Hall, E.2.

WANDSWORTH.—27th January. Borough Council. Street lighting equipment. (See this issue.)

**Manchester.**—1st February. Housing Committee. Electrical installations in housing schemes. (See this issue.)

**New Zealand.** — WELLINGTON. — 2nd March. Director General, Post and Telegraph Department. Radio transmitting and receiving equipment. (E.S.B. 13500/53. Ten/7977.)

16th March. State Hydro-Electric Department. Eight 6,666 kVA, 110/19·05 kV transformers. (E.S.B.13182/53. Ten/7949.)*

**Prestwich.**—30th January. Borough Council. Electric lamps and equipment for one year. Borough surveyor, Town Hall.

**Solihull.**—6th February. U.D.C. Electrical fittings and lamps and electric street lighting fittings for one year from 1st April next. Surveyor, 90, Station Road.

**South Africa.** — JOHANNESBURG.— 28th January. South African Railways. Electrically-driven 30,000 gal/hr centrifugal pumps. (E.S.B. 13452/53. Ten/7959.)*

**Southern Rhodesia.**—BULAWAYO.— 2nd February. Municipality. Electricity meters. (E.S.B. 13258/53. Ten/7981.)

**Swansea.**—6th February. Borough Council. Electric lamps for public lighting for one year. Borough engineer, Guildhall.

**United States.**—DENVER, COLORADO.— 21st January. Bureau of Reclamation. 230 kV power circuit breaker for Jamestown substation. (E.S.B. 13411/53. Ten/7967.)*

**Uruguay.** — MONTEVIDEO. — 5th February. Usinas Electricas y los Telefonos del Estado. Accumulators, accumulator plates, etc., for telephone exchanges. (E.S.B. 12689/53. Ten/7983.)*

### ORDERS PLACED

**Barking.** — Corporation. Recommended. Street lighting in Lodge Avenue (£2,588).—Harland & Wolff, Ltd.

**Croydon.** — Corporation Education Committee. Renewal of electrical wiring at the Selhurst Grammar School for Boys (£2,056).—Troughton & Young, Ltd. Renewal of wiring at the Selhurst Grammar School for Girls (£1,858).—Girdlestone & Co., Ltd.

**Ilford.**—Borough Council Housing Committee. Recommended. 100 additional immersion heaters for installation in houses on the Maypole estate (£6 8s per heater).—Santon, Ltd.

**Middlesex.**—County Council Highways Committee. Recommended. Automatic traffic control signals at the junction of High Street and Thames Street, Staines (£1,346).—Automatic Telephone & Electric Co. Ltd.

**Sedgley.**—U.D.C. Street lighting, Tipton Street, Vicar Street and Gospel End Street (£1,881).—Revo Electric Co.

**Southampton.**—Corporation. Recommended. Installation of electricity in the civil defence main control centre (£1,486). —Newports Electrics (Southampton), Ltd.

**Stockport.** — Corporation. Recommended. Four sets of vehicle actuated traffic control signals for Trunk Road A.6 (£5,511).—Automatic Telephone & Electric Co., Ltd.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Bacup.**—Houses (165), on site at Tunstead Road; C. G. Everatt, town clerk, Stubbylee Hall.

**Basingstoke.**—Factory and offices, Winchester Road; Airpak, Ltd., 76, Grosvenor Street, W.1.

**Bathavon.**—Houses (25), Corston; M. Whalley, architect, 8, Cleveland Place East, Bath.

**Billingham-on-Tees.**—Houses (109), for the U.D.C.; C. M. Yuill, Ltd., builders, Villiers Street, West Hartlepool.

**Blackheath.**—Works extensions; Tube Manipulations, Ltd., Masters Lane.

**Boston.**—Out-patients' and physiotherapy depts. at Johnson Hospital; W. E. Norman Webster & Son, architects, 1a, Station Street, Spalding.

**Bristol.**—Shops, Fairfax Street, with provision for multi-storied building over at a later date; J. N. Meredith, city architect, Eagle House, Colston Avenue.

**Cheltenham.**—Offices, workshops, etc., Tewkesbury Road; Grimshaw Kinnear, Ltd., civil engineering contractors, 111, Promenade.

**Chester-le-Street.**—Houses (19), Pelton, for R.D.C.; F. Bowman, architect, Estate Office, Birtley.

**Cockermouth.**—Houses (20), Slatefell; North-Eastern Housing Association, Curzon House, Maryport.

**Cradley Heath.**—Works extensions, Station Road, Old Hill; Evanwoods, Ltd., precision engineers.

**Ebbw Vale.**—Concert hall, staff canteen, youth club building, and extensions to existing welfare buildings (£110,000); Richard Thomas & Baldwins, Ltd., Ebbw Vale Works.

**Edgware.**—Synagogue; United Synagogue, Woburn House, Upper Woburn Place, W.C.1.

**Exeter.**—Dwellings (42), Whipton Barton estate; Woodman & Son, Ltd., builders, Bartholomew Street.

**Glendale (Northumberland).**—Houses (90); A. R. Field, R.D.C. surveyor, Council Offices, Wooler.

**Greenford.**—Factory extension, Oldfield Lane; J. Lyons & Co., Ltd., Cadby Hall, W.14.

**Havant and Waterloo.**—Houses (100), on sites at Bedhampton and Purbrook, for U.D.C.; surveyor, 1, Park Road North, Havant.

**Horsham.**—Offices, showrooms and storage facilities; J. Alsford, Ltd., timber merchants, King Street, Worthing.

**Jarrow-on-Tyne.**—Bakery in Leam Lane for Jarrow and Hebburn Co-operative Society (£85,000); C.W.S. Building Department, West Blandford Street, Newcastle-on-Tyne.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

**Keynsham.**—Houses, West Park estate; surveyor, Council Offices, Keynsham, Bristol.

**Kidderminster.**—First 200 houses of scheme for 600 houses on estate at Habberley; J. G. Stewart, borough engineer, 110, Mill Street.

**Liverpool.**—Extensions to factory, Edwards Lane, for Norman & Burgess, Ltd.; Ormrod & Banister, architects, 49, Rodney Street, Liverpool.

Single-storey office block at Errington Street for Williamson Kay & Co., Ltd.; Heaton & Crawford, architects, 81, Dale Street, Liverpool.

**London.**—HACKNEY.—Dwellings (50), Somerford Grove; Fredk. Gibberd, architect, 8, Percy Street, W.1.

PADDINGTON.—Welfare block at Cleansing Wharves; Guy H. Nicholls, architect, 66a, Wigmore Street, W.1.

ST. PANCRAS.—Office block, Euston Road; Waterhouse & Ripley, architects, Staple Inn Buildings, W.C.1.

WESTMINSTER.—Offices, Dean Farrer Street; Federation of British Industries, 21, Tothill Street, S.W.1.

**Luton.**—Extensions and rebuilding works; George Kent, Ltd., engineers, Biscot Road.

**Maidstone.**—Showrooms and offices, Brewer Street; Louis G. Ford, Ltd., Station Parade, Eastbourne.

**Manchester.**—Factory, Enoch Street and Queens Road, Miles Platting, for B. Bloom, Ltd.; Drury & Gomersall, architects, Roxy Cinema, Oxford Street, Manchester.

Single-storey extension to factory at Owen Street and Bank Street, Holme, Manchester, for Samuel Bros. (Plastics), Ltd.; Peter Cummings, architect, Jacey House, Oxford Street, Manchester.

**Middlesbrough.**—Proposed Middle Beck (No. 2) County Secondary School; Cairns and Byles, consultant engineers, 2, Osborne Road, Newcastle-on-Tyne.

**Millom.**—Houses (53), Holborn Hill, Horn Hill and The Green; surveyor, Rural Council Offices.

**Newcastle-on-Tyne.**—Ambulance depot, Millers Road; city architect, 18, Cloth Market.

Houses and flats for City Council. Builders: G. Bainbridge, West Road, Newcastle (9 houses and 12 flats), Fisher & Co., Ltd., Kenton, Newcastle (22 houses) and E. Jeffcock, Ltd., New Bridge Street, Newcastle (29 houses and 12 flats).

**Northallerton.**—Primary school; J. H. Napper, architect, 56, Eldon Place, Newcastle-on-Tyne.

**Oswestry.**—Memorial hall at Oswestry School; E. W. Gittins & Sons, Foundry Buildings, Johnstown, near Wrexham.

Houses (74); borough surveyor.

**Oxford.**—Extensions at St. Hilda's College; Richardson & Houfe, architects, 31, Old Burlington Street, London, W.1.

Offices and showrooms, Chapel Street; Hooper & Jones, building contractors.

**Poole.**—Technical college; Elder & De Pierro, architects, 33, Welbeck Street, London, W.1.

Houses (80), Fraser Road; J. R. Barron, borough surveyor, Municipal Buildings.

**Redditch.**—Additions and alterations to Public Library and School of Art; E. Buckley, U.D.C. surveyor, Council House.

**Richmond (Yorks).**—Houses (234), Gilling, Colburn and Hipswell; R.D.C. surveyor, Market Place.

**Rochdale.**—Houses (122), Alder Road estate, Castleton; borough surveyor.

**Sedgley.**—Works extensions; Hagley Engineering Co., Ltd., Clarence Street, Upper Gornal.

**Sheffield.**—Additions and alterations at Royal Hospital; J. Mansell Jenkinson & Son, architects, 18, Norfolk Row, Sheffield, 1.

**Siddick (Cumb).**—Miners' hall for N.C.B.; Architect's Department, Ashfield Tower, Gosforth, Northumberland.

**Southampton.**—Six shops and flats, Harefield estate; R. Corben & Son, Ltd., builders, 19, Waterloo Road.

**Southend-on-Sea.**—Factory at the Airport; Aviation Traders, Ltd., aircraft engineers, 15, Great Cumberland Place, London, W.1.

**South Shields.**—Additions to Town Hall (£80,000) and clinic and ambulance station at Boldon Lane (£32,000); J. Reid, borough engineer.

Factory at Mill Dam for Elsey & Gibbons, Ltd., plumbing engineers.

**Stockton-on-Tees.**—Twelve houses in Kilburn Road; G. P. Stainsby, architect, 57, High Street.

Office block for the tank department of the South Durham Steel & Iron Co., Ltd.; own architects.

**Stoke-on-Trent.**—Development of 49-acre estate at Fegg Hayes for housing; city engineer, Town Hall.

**Stokesley.**—Houses (48); R.D.C. surveyor.

**Stretford.**—Offices and warehouse at Hadfield Street for Tom Fairclough, Ltd.; John Eaton & Son, architects, Croft Cottage, Stamford Street, Ashton-under-Lyne.

**Sunderland.**—Garage and bus station for the Northern General Transport Co., Ltd., Gateshead; Fennell & Co., architects, Bridge End Chambers, Chester-le-Street.

Showroom, Durham Road, for Northern Autoport, Ltd.; Newrick & Blackbell, architects, John Street.

Houses (132), Grindon Village; L. W. Evans, Ltd., builders, Norfolk Street.

**Swansea.**—Licensed premises, The Kingsway; Truman, Hanbury, Buxton & Co., Ltd., The Brewery, Burton-on-Trent.

Factory extension, Fforestfach; Windsmoor (London), Ltd., 174, Old Street, London, E.C.1.

Fire station, Grove Place; borough architect.

**Tipton.**—Extensions to factory, Hainge Road; Bacon Eades & Co., Ltd., structural engineers, Beacon Works.

**Tynemouth.**—Civil Defence control centre (£14,000); borough engineer, 16, Northumberland Square, North Shields.

**Whitley Bay.**—Church hall, St. Peter's Church, Monkseaton; H. L. Honeyman, architect, 6, Eldon Square, Newcastle-on-Tyne.

Dairy at Hill Heads for Coast Creamery, Ltd.; C. Solomon, architect, St. Mary's Place, Newcastle.

Showroom and offices for R. Wilson (Monkseaton), Ltd.; J. M. Dawson, Ltd., builders, Ilfracombe Gardens, Whitley Bay.

**Wigan.**—Factory for Turners Asbestos Co., Ltd.; J. Gerrard & Sons, Ltd., Swinton, near Manchester.

Flats (20), Chorley; R.D.C. surveyor.

**Wigton.**—Bus station, King Street, for Cumberland Motor Services, Ltd., Whitehaven.

**Wood Green.**—Works extensions; Light & Power Accessories, Ltd., Wellesley Road.

**Worksop.**—Factory at Langold; Cash Harwood & Co., Ltd., cotton doublers, Lawn Mills, Mansfield.

# Bitumen Company's Jubilee

ONE of the old-established companies in the field of bituminous products, the Dussek Bitumen and Taroleum Co. of Bow, London, is celebrating its golden jubilee. Although founded fifty years ago, the name Dussek has been associated with tars and bituminous products for over a century. In the early days of the company difficulties arose over the supply of crude Trinidad bitumen and Mr. A. E. H. Dussek, the founder of the company, visited Trinidad to arrange for shipments to be made to England.

In addition to manufacturing cable joint box filling compounds from the crude Trinidad bitumen which was refined in the company's works, there was also a very substantial demand for compounds for the mechanical protection of cables laid in wooden and other troughing.

Mr. A. E. H. Dussek then patented a solid laid cable by moulding sectioned troughs from Cuban bitumen, laying bare conductors in them and filling them with bitumen compound. Although economical and entirely satisfactory in service for many years, the development of the armoured cable superseded this method.

Continued research and development work on insulating compounds to keep pace with the higher voltages at which electricity supply was being generated and distributed necessitated the establishment of a high voltage research laboratory. One of Dussek's more notable contributions was the wartime emergency cable jointing system which proved invaluable in maintaining communications despite heavy bomb damage. One element of this system was a cold cable-jointing compound which required no heat application and therefore obviated the risk of accidental ignition or explosion from gas leaks. The present management, in addition to Mr. A. J. Dussek, includes Messrs. A. J. A. Kennedy, M.C., E. R. Hatt, M.Inst.P., E. A. Deacon, A.M.I.E.E., and E. A. Dussek, Mr. A. E. H. Dussek being retained as consultant.